

STRUCTURE OF THIS MICROCARD (BASIC INSTRUCTIONS)

A02 = How to use this microcard		1	2	3		4
A01 = Structure of microcard					SIS	
B01 = Trouble-shooting chart	-A-	***X*	X*XXX	XXXXX	XXXXX	*XXXX X
	-B-	*XXXX	XXXXX	XXXXX	XXXXX	XXXXX XXX
	-C-	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX XXX
	-D-	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX XXX
	-E-	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX XX
	-F-	XXXXX	XXXXX	XXXXX	XXX	
	-G-	XXXXX	XXXXX	XXXX		
	-H-					
	-J-					
	-K-					
	-L-					
	-M-					
N01 = Service information	-N-	*XXXX	XXXXX	XXXXX	XXX	*X XX*
		12345	67890	12345	67890	12345 678
			1		2	
						Index
N28 = Table of contents and publication information						

- 1 = Special features
- 2 = Safety and precautionary measures
- 3 = Testers and tools
- 4 = Installation position of components

- a. Read from left to right.
- b. Title of micropicture (appears on each micropicture).

E16	Product/component/test step	
	Coordinate	

c. Limits of section

<div><div><div></div><div></div><div></div></div></div>	<div><div><div></div><div></div><div></div></div></div>	<div><div><div></div><div></div><div></div></div></div>	<div><div><div></div><div></div><div></div></div></div>
Beginning	Mid-section	End	One-page section

A01		=> <=
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HOW TO USE THIS MICROCARD

Trouble-shooting instructions for system:

Motronic MP 3.1

Descriptions, photos, terminal designations and special features refer to the following vehicle:

YUGO 65 (YUGO GV plus)  
with 1.3 l / 4-cylinder engine, year of manufacture 02.90->

These basic instructions are comprehensive trouble-shooting instructions. They must not be used as vehicle-specific instructions. Caution! Descriptions and photographs may deviate from the vehicle-specific brief instructions.

Mandatory set values, terminal assignments and special features should be taken from the vehicle-specific brief instructions only. For brief instructions, see table of contents Microcard KFZ-00..

A02		=> <=
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## SPECIAL FEATURES

- \* Motronic MP 3.1 with self-diagnosis (with fault memory and actuator test).

The actuator test makes it possible to actively check several outputs of the control unit and the Motronic components connected to them including the connecting leads.

The following Motronic components can be activated (periodically with engine stopped):

1. Injection valves
2. Idle actuator
3. Tank-vent valve (TEV)

- \* Load detection by way of intake-manifold vacuum sensor in control unit (no air-flow sensor!).

- \* Adaptive lambda closed-loop control.

- \* Adaptive tank ventilation with active-carbon filter and two tank-vent valves (TEV + TES)

Note:

TEV = Tank-vent valve (pulsed)

TES = Tank-ventilation switching valve (switched)

- \* Joint sensor for engine speed and reference mark.

- \* Idle-speed regulation.

- \* External ignition output stage (trigger box).

- \* Throttle-valve potentiometer instead of throttle-valve switch (additional load signal for acceleration/emergency-operation load signal).

- \* Fault lamp ("Check Engine") in instrument panel.

For production reasons:  
continued on the following  
coordinate.

## SPECIAL FEATURES (continued)

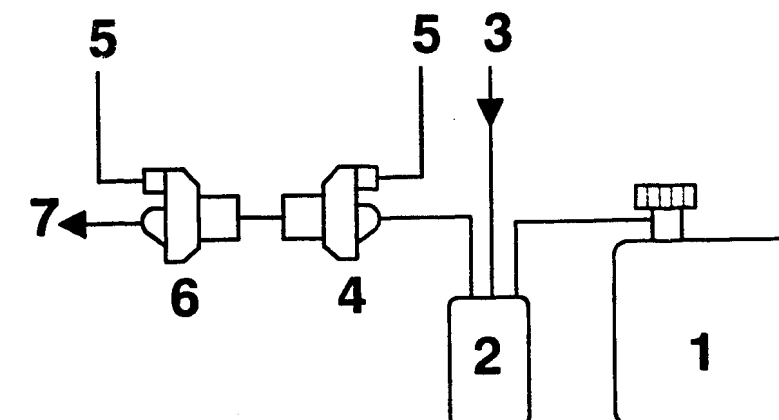
### Tank ventilation system

Vehicles featuring lambda closed-loop control are equipped with a closed tank ventilation system (see block diagram).

The fuel vapours produced in the fuel tank are stored in the active-carbon filter. During engine operation, the engine draws off the fuel vapours. A pulsed tank-vent valve, which is installed between active-carbon filter and intake manifold, meters the supply of fuel vapour.

The Motronic control unit regulates the opening cross-section of the tank-vent valve (TEV) by way of an on/off ratio as a function of the operating condition of the engine. Excessive changes in the mixture are thus avoided. When no current is being applied, i.e. when the ignition is switched off, the tank-vent valve (TEV) is opened. In order to preclude dieseling after switching off the ignition, a second valve, the so-called tank-ventilation switching valve (TES), is installed between active-carbon filter and intake manifold.

In contrast to the tank-vent valve, the tank-ventilation switching valve is closed when deenergized (opens with "ignition ON") and thus stops the engine drawing fuel out of the active-carbon filter after switching off the ignition.



KMK 121

- 1 = Fuel tank
- 2 = Active-carbon filter
- 3 = Air supply
- 4 = Tank-vent valve (TEV)
- 5 = Electrical connections
- 6 = Tank-ventilation switching valve (TES)
- 7 = to intake manifold

## SAFETY AND PRECAUTIONARY MEASURES

Be sure to observe safety and precautionary measures so as to avoid risk to persons and to prevent damage to the engine, trigger boxes, control units or the ignition system.

### CAUTION!

High-energy ignition system with dangerous high and low voltages!

Touching live parts or terminals may be highly dangerous (both on the primary and secondary sides).

For compression test, detach main relay in order to prevent undesirable injection by injection valves and high-voltage flashovers.

Do not short-circuit ignition coil term.1 to ground (e.g. for stopping the engine). Ignition coil and possibly control unit shall be destroyed.

Never connect positive terminal of battery to ignition coil term.1. Control unit shall be destroyed.

When fitting an alarm system, following directions of installation instructions for Motronic vehicles or SIS microcard PKW 012. Ensure that the alarm relay is not disturbed by external fields (e.g. ignition cables) and therefore responds incorrectly.

## SAFETY AND PRECAUTIONARY MEASURES (CONTINUED)

Never start engine without battery securely connected (battery terminals tightened). Do not disconnect battery from vehicle electrical system with engine running.

Do not use a fast charger for starting the engine.  
Provide starting assistance only with second 12 V battery and jump leads.  
Caution! Owing to non-standardized requirements of vehicle manufacturers with regard to electronic products, we advise against using a 24 V battery for starting assistance.

When charging the battery in the vehicle or providing starting assistance, follow the operating instructions for the fast charger as well as instructions of the vehicle manufacturer.

Disconnect battery from vehicle electrical system before charging or fast-charging.

Incorrect polarity of the supply voltage, e.g. through incorrect connection of the battery or ignition coil, may lead to the destruction of a control unit.

Do not connect or disconnect wiring-harness plugs from control units or trigger boxes with the ignition on.

Remove control units at temperatures above + 80° C (paint-drying installation).

Remove control units before carrying out electric welding work.

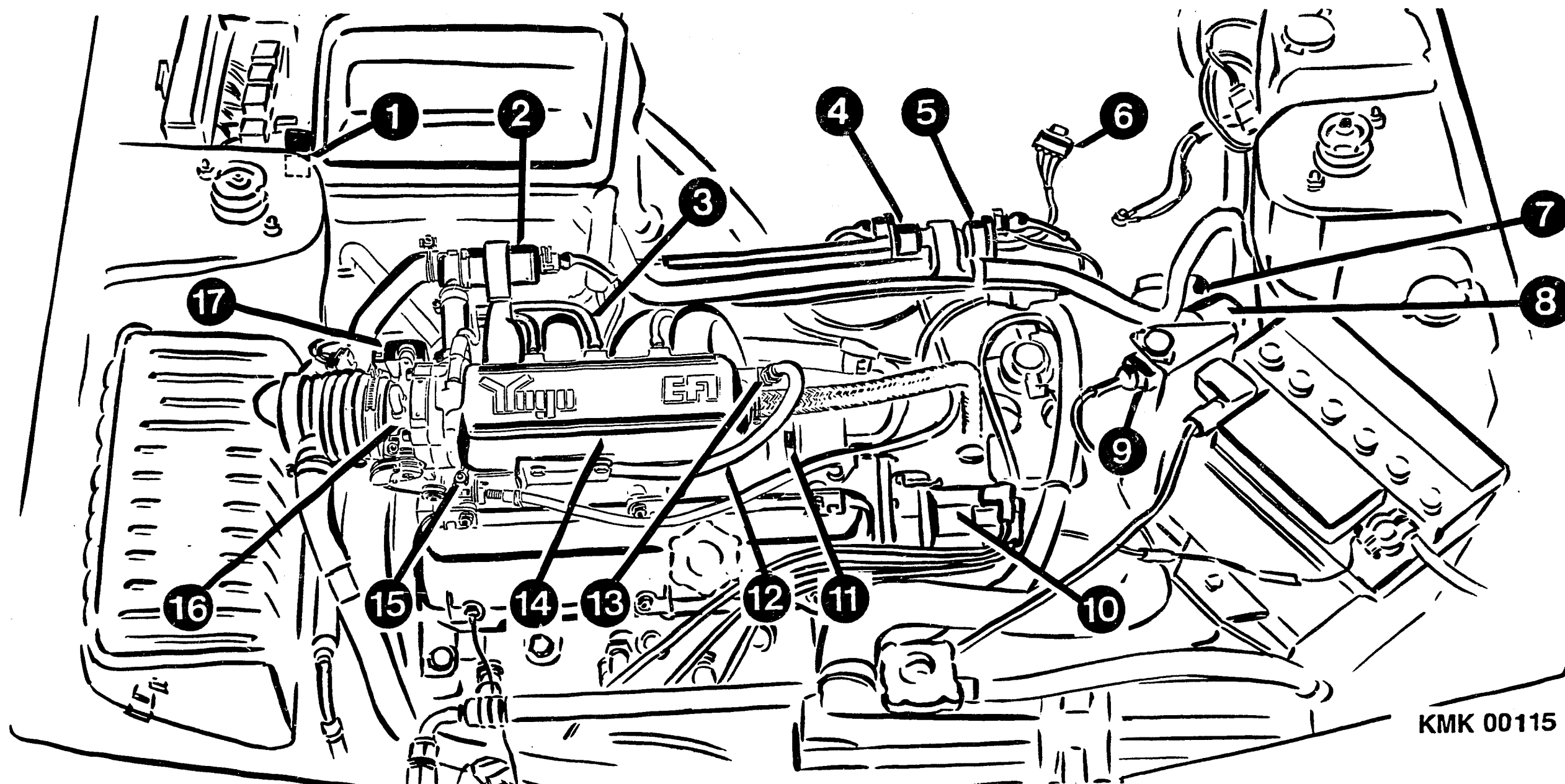


## TESTERS AND TOOLS

Name	Designation	Part No.
Engine tester	e.g. MOT 201	0 684 000 201
	MOT 300	0 684 000 300
	MOT 400	0 684 000 400
Exhaust-gas analyzer	e.g. ETT 008.02	0 684 100 802
	ETT 008.03	0 684 100 803
Multimeter (internal resistance at least 20 k $\Omega$ /V)	e.g. Digital multimeter	
	MMD 301	0 684 500 301
Pressure gauge, 6 bar	Quality class 1.0 Scale div. 0.1 bar	1 687 231 154
or Pressure measuring device		KDJE-P 100
or Pressure measuring device (no longer available)		KDEP 1034
Three-way line as connection part for KDJE-P 100 and KDEP 1034		KDJE-P 100/13
Test-cable set		1 687 011 208
Pocket system tester KTS 300		0 684 400 300
Universal adapter lead		1 684 465 217
Evaluation unit (for flashing code)		KDAW 9980

## TEST EQUIPMENT AND TOOLS (continued)

Description	Part no.
Feeler gauge for measuring sensor air gaps (up to 1 mm)	Commercially available
Lubricant for engine-speed and reference-mark sensor	Molykote Longterm 2, commercially available
Chassis dynamometer e.g. LPS 96 or LPS 002	0 680 017 001 0 680 100 200
Test lead 2-pole, for measuring resistances and signals e.g. at injection valves	1 684 463 093
Test leads for correct connection of testers at component plugs	KDZS 0004 (2.8 mm wide)  KDZS 0005 (6.3 mm wide)
Mounting paste VS 14016 Ft for Lambda sensor and exhaust-gas screw plug	5 964 080 112
Hose clamber for pinching off fuel and air hoses	Commercially available



KMK 00115

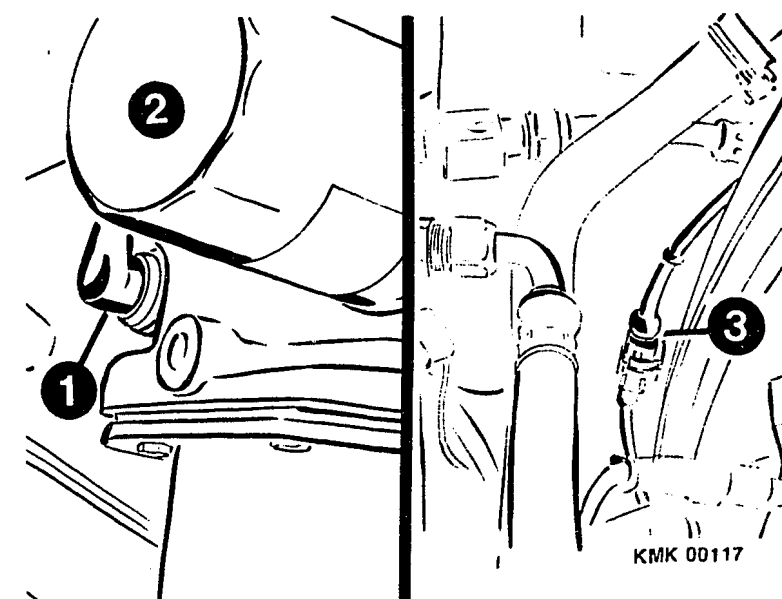
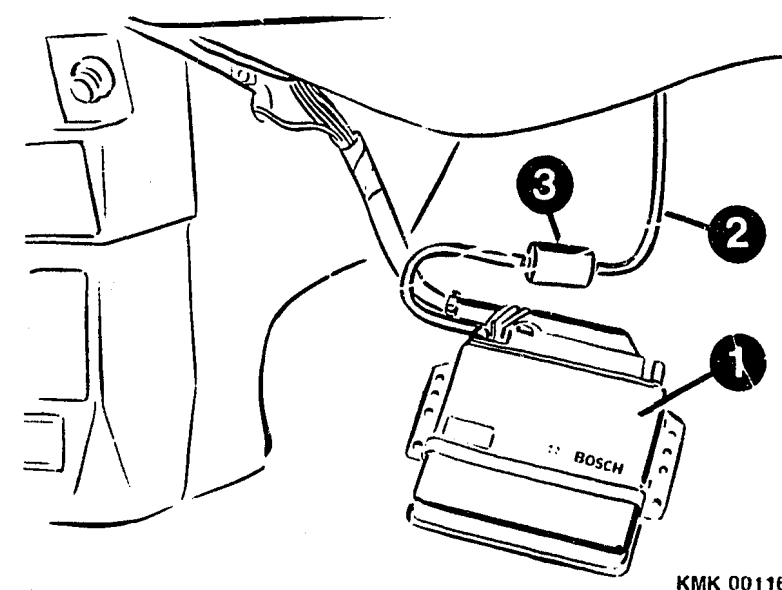
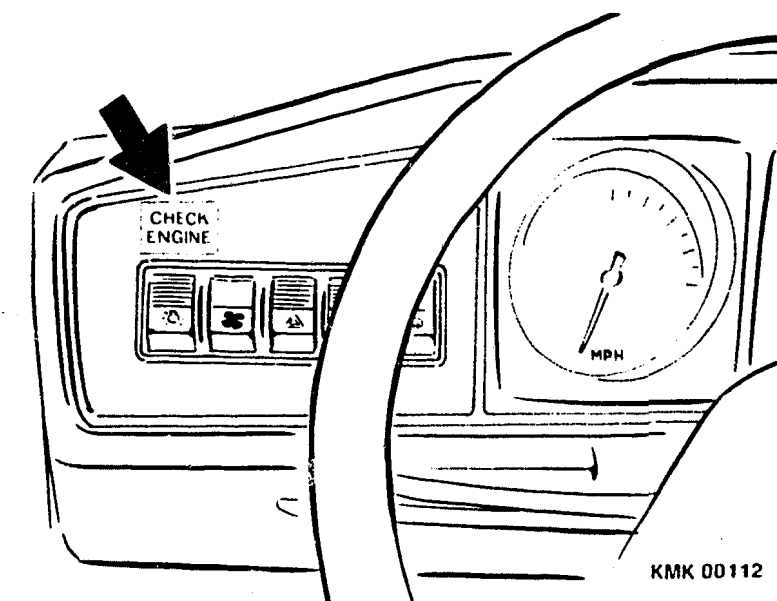
# INSTALLATION POSITION OF COMPONENTS

- |  |   |  |
|--|---|--|
| 1= Main and pump relay                                     | 6= Diagnosis plug                                 | 12= Fuel inlet hose                    |
| 2= Idle actuator   | 7= Active-carbon filter<br>(for tank ventilation) | 13= Pressure-gauge connection<br>point |
| 3= Connecting lead to pressure<br>sensor (in control unit) | 8= Ignition coil                                  | 14= Intake manifold                    |
| 4= Tank-ventilation switching<br>valve (TES); color: black | 9= Ign.-trigger-box plug                          | 15= Motronic ground connection         |
| 5= Tank-vent valve<br>(TEV); color: gray                   | 10= H.T. distributor                              | 16= Throttle-valve assembly            |
|  | 11= Injection valve (cyl.1)                       | 17= Throttle-valve sensor              |

## INSTALLATION POSITION OF COMPONENTS (continued)

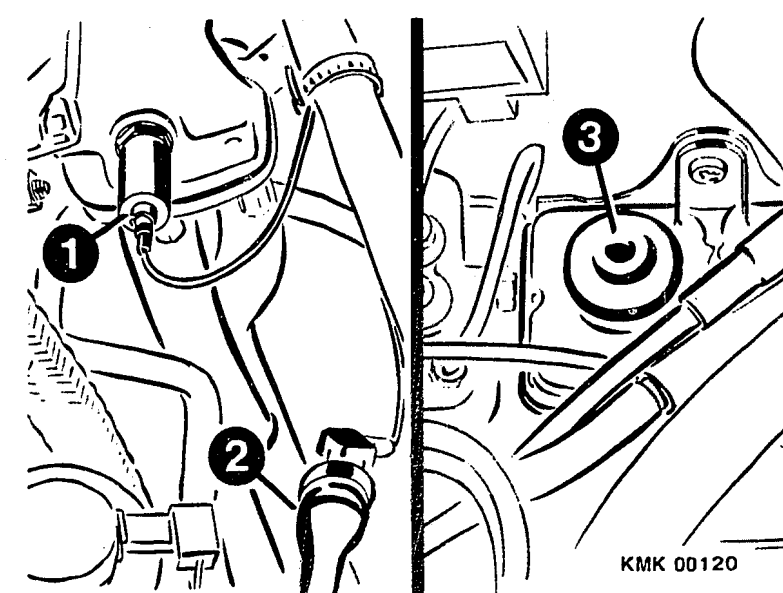
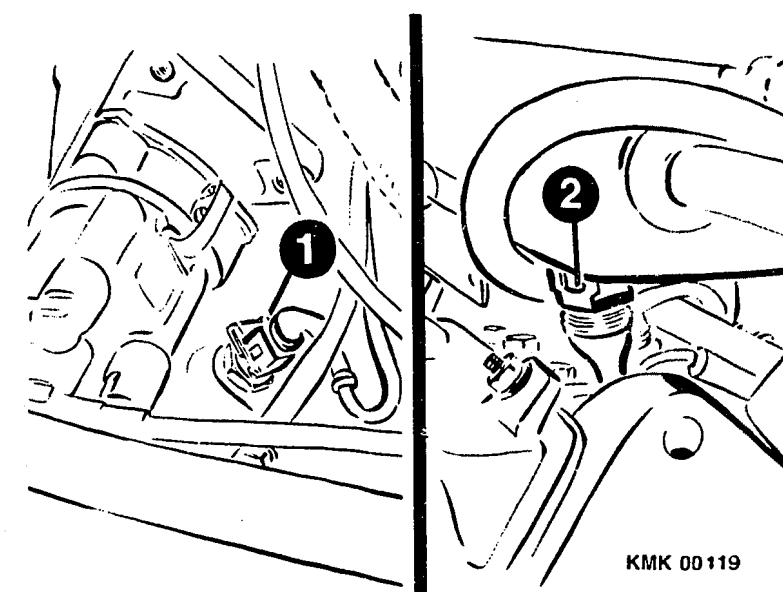
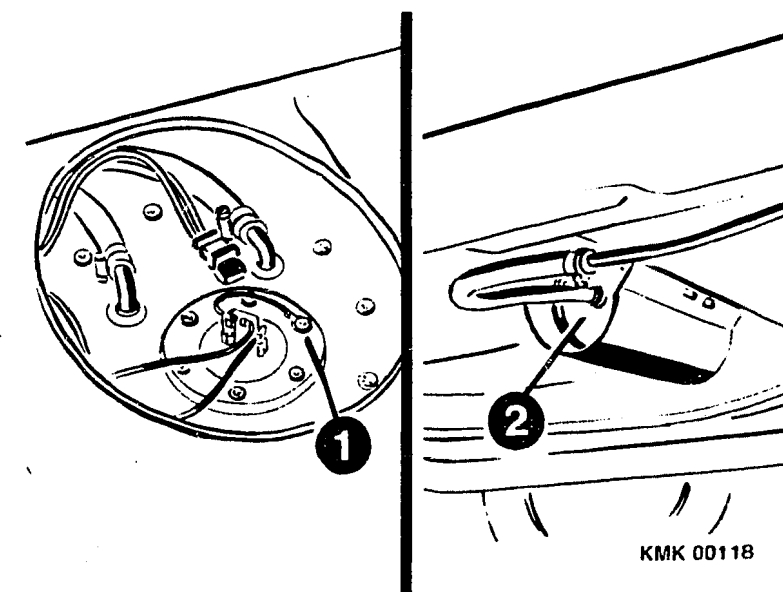
The installation locations always refer to the direction of travel.

- \* "CARB" lamp (Check Engine):  
On left in instrument panel (top picture, arrow).
- \* Motronic control unit:  
In passenger compartment on passenger's side (center picture).  
Item 1 = Motronic control unit  
Item 2 = Connecting hose between intake manifold and pressure sensor  
in control unit  
Item 3 = Pulsation damper
- \* Engine-speed/reference-mark sensor:  
Front right in engine block next to oil filter (bottom picture, left).  
Item 1 = Engine-speed/reference-mark sensor  
Item 2 = Oil filter  
Item 3 = Plug connection to engine-speed/reference-mark sensor  
(bottom picture, right).



# INSTALLATION POSITION OF COMPONENTS (continued)

- \* Electric fuel pump:  
In-tank electric fuel pump. Access from beneath rear seat bench (see top picture, item 1).
- \* Fuel filter:  
On underside of vehicle in front of fuel tank (top picture, item 2).
- \* Temperature sensor (engine):  
Screwed in beneath ignition distributor in engine block (center picture, item 1).
- \* Temperature sensor (air):  
Screwed in at bottom of intake manifold (center picture, item 2).
- \* Lambda sensor:  
Screwed in on side of exhaust manifold (access by way of engine compartment).  
Bottom picture: Item 1 = lambda sensor  
Item 2 = sensor plug connection
- \* Active-carbon filter (for tank ventilation):  
Rear left in engine compartment; in vicinity of left-hand spring-strut dome (bottom picture, item 3)



## HOW TO USE TROUBLE-SHOOTING CHART AND TROUBLE-SHOOTING PROGRAM

The TROUBLE-SHOOTING CHART starts with Coordinate B03 and contains customer complaint (fault symptom/fault characteristic feature) together with several possible causes in each case (component faults) and coordinate information for detailed trouble-shooting. If no coordinates are given, this is because the causes concerned do not require any test instructions.

In the event of a clearly established customer complaint, proceed consecutively and step by step as indicated in the trouble-shooting instructions in the stated sequence of possible causes.

Trouble-shooting should always be commenced with self-diagnosis (if provided) or with the universal test adapter (if possible). Only then should trouble-shooting be continued in line with the trouble-shooting chart.

In the event of a customer complaint which is not clear-cut, all causes indicated in the trouble-shooting chart must be tested. In order to avoid incorrect measurements, all causes are to be checked in the specified sequence (on account of the interdependence of test steps).

If the cause of the customer complaint has still not been eliminated after testing all possible faults, fit new prescribed ignition coil and/or trigger box/control unit.

## HOW TO USE TROUBLE-SHOOTING CHART AND TROUBLE-SHOOTING PROGRAM (CONTINUED)

The TROUBLE-SHOOTING PROGRAM contains all system and component tests indicated in the trouble-shooting chart. It is sub-divided into three rows of boxes.

The left-hand column contains test instructions and set values.

The center column contains information on trouble-shooting and fault elimination.

The right-hand column contains pictures/connection diagrams linked to the text together with explanatory notes.

If the questions posed in the left-hand column can definitely be answered with "yes", trouble-shooting is to be continued with the next box below.

If the answer to the question is "no", the center column must be applied and the tests performed in the sequence indicated there.

Following fault elimination, repeat test as a check.

### TEST PREREQUISITES:

- Battery fully charged
- Engine in proper mechanical working order (e.g. compression, valve clearance etc.)
- Engine at operating temperature of approx. +80°C (if necessary)
- Proper connection of all connectors of wiring harness

## TROUBLE-SHOOTING CHART

**Customer complaint (fault symptoms)**

1. Starting motor operates, engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Idle problems (engine speed, exhaust gas).
4. Poor throttle take-up, flat spot during acceleration.
5. Engine missing (ignition, injection).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

11. Fault Lamp											Cause (component fault)	Coord.
*	*	*	*	*	*	*	*	*	*	*	Self-diagnosis	B11
*											Voltage at control unit	C25
*											Engine-speed/reference-mark sensor	C27
*		*	*	*	*						Primary signal	D05
*				*							Ignition trigger box	D06
*		*		*	*						Ignition coil	D09
		*	*	*	*	*					Secondary patterns	D11
		*	*	*							Interf.-suppr. resistors	D11
*		*				*	*				Solenoid-op. inj. valves	D13/19
	*	*	*								Idle actuator	D15
	*	*	*				*				Tank-vent valve	D17
				*	*						Interference	D20
*		*			*	*					Fuel pressure	D21
				*				*			Fuel delivery	E07
*	*	*	*								Air-intake system	E09
	*	*	*				*				Tank ventilation	E13
					*						Overrun cutoff	E19
		*									Idle speed	E21
		*									Exhaust gas	E23
		*			*						Throttle valve	—
*	*	*	*		*	*		*	*		Ignition angle	—
*	*	*	*	*	*	*	*	*	*	*	Control unit	—

For production reasons:  
continued on the following  
coordinate.

# HOW TO USE SELF-DIAGNOSIS, SELF-DIAGNOSIS TEST TABLE AND TROUBLE-SHOOTING PROGRAM

This vehicle is provided with a Motronic control unit featuring self-diagnosis.

When performing trouble-shooting, the first step is thus to carry out self-diagnosis.

## 1. TESTER DIAGNOSIS

The self-diagnosis fault memory can be read out by means of the pocket system tester KTS 300 (0 684 400 300) with program module PPG 204 as of status 8.90 .

Pay attention to operating instructions for KTS 300. KTS 300 is connected up by way of universal adapter lead to diagnosis plug in vehicle (top picture):

Lead with yellow encoding to connection A

Lead with green encoding to connection B

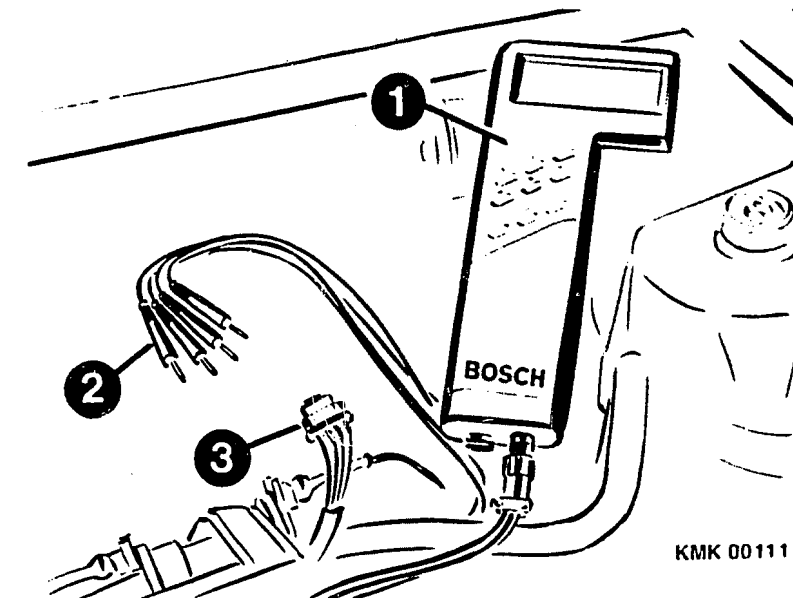
Red lead to connection C (+12 V).

Black lead to connection D (ground).

See bottom picture.

### Note:

Other diagnosis possibilities (actuator diagnosis etc.), which would be possible with the KTS 300 in conjunction with newer program module statuses, are not evaluated with these vehicles. Actuator diagnosis must therefore be performed manually (Coordinate B17).



1 = Pocket system tester  
KTS 300

2 = Universal adapter lead

3 = Diagnosis plug (4-pole)

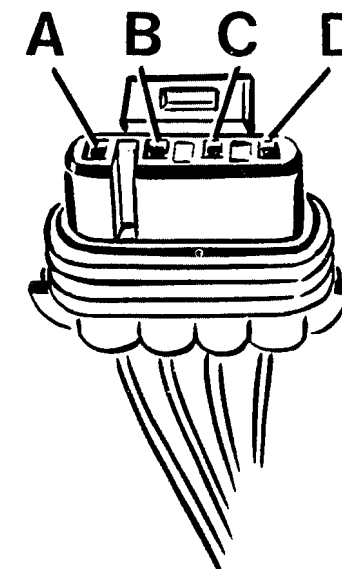
### Diagnosis plug:

A = Stimulation lead

B = Serial interface

C = +12 V (term.30)

D = Ground



HOW TO USE SELF-DIAGNOSIS, SELF-DIAGNOSIS  
TEST TABLE AND TROUBLE-SHOOTING PROGRAM  
(CONTINUED)

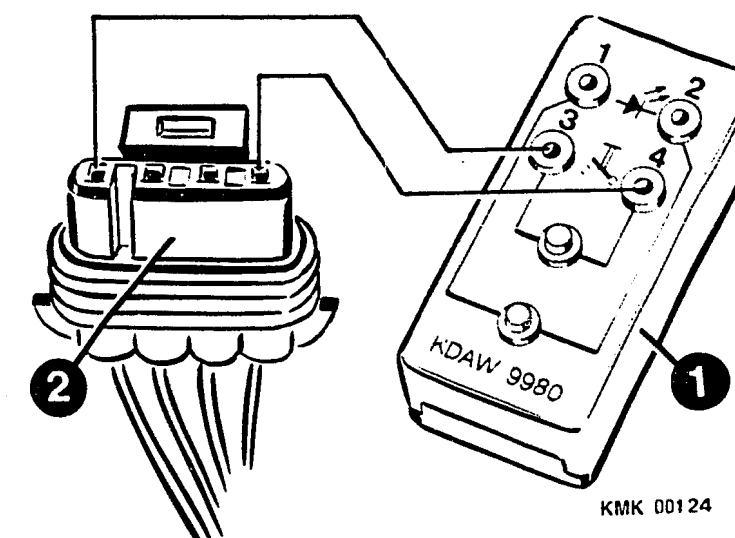
2. FLASHING-CODE DIAGNOSIS

As an alternative to the KTS 300, the self-diagnosis can be read out by way of a flashing code. The flashing-code diagnosis is activated with the evaluation unit KDAW 9980 (picture). The flashing code is output via the fault lamp installed in the instrument panel ("Check Engine").

The evaluation unit is connected to the diagnosis plug in the vehicle:

Connect socket 3 to diagnosis plug term. A and socket 4 to diagnosis plug term. D or vehicle ground.

Activation of the flashing-code diagnosis is described as of Coordinate B13.





HOW TO USE SELF-DIAGNOSIS, SELF-DIAGNOSIS TEST  
TABLE AND TROUBLE-SHOOTING PROGRAM  
(CONTINUED)

The self-diagnosis test table starting as of  
Coordinate B19 takes account of both the KTS 300  
and the flashing code, and is arranged according  
ing to fault-code numbers indicated by the KTS 300.  
The "fault indication" column sometimes includes  
two types of fault optionally indicated by the  
tester, e.g.:  
Open circuit/short circuit to ground (= 1st type of fault)  
Short to positive (= 2nd type of fault)

The self-diagnosis test table contains the following:

- Fault indication in pocket system tester  
with fault code, i.e. tested components  
or system functions
- Corresponding flashing-code output if  
no tester available
- Test instructions/test conditions (brief  
instructions only)
- Terminals (brief instructions only)
- Set-value data (brief instructions only)
- Indication of coordinates for trouble-  
shooting and fault elimination in sub-  
sequent self-diagnosis trouble-shooting  
program

HOW TO USE SELF-DIAGNOSIS, SELF-DIAGNOSIS  
TEST TABLE AND TROUBLE-SHOOTING PROGRAM  
(continued)

The self-diagnosis trouble-shooting program  
as of Coordinate B21 is split up into 3 columns.

The left-hand column contains test instructions  
and set values.

The center column contains information on  
trouble-shooting and fault elimination.

The right-hand column contains the picture/  
terminal diagrams accompanying the text together  
with explanatory notes.

If the questions in the left-hand column can  
definitely be answered with "yes", the trouble-  
shooting is to be continued with the next box below.

If the answer to the question is "no", reference  
must be made to the center column and the tests  
performed in the sequence indicated there.  
If the self-diagnosis indicates a fault, however  
neither system nor component faults can be found,  
the fault memory is to be cleared, a test drive  
performed and the self-diagnosis re-interrogated.

If no further faults are indicated by the self-  
diagnosis and the customer complaint (fault  
symptoms) has still not been eliminated, trouble-  
shooting must be continued with the trouble-shoot-  
ing chart as of Coordinate B03.

## SELF-DIAGNOSIS

### Check function of fault lamp ("Check Engine")

1. Switch on ignition:  
Fault lamp must light up (otherwise lamp, lead, main relay or control unit is defective)
2. Start engine:
  - a). Lamp goes out on starting engine or immediately afterwards → no fault stored
  - b). Lamp goes out approx. 3 s following start of engine → at least one "unimportant" (not critical in terms of emissions) fault has been stored
  - c). Lamp lights up all the time with engine running → at least one "important", i.e. critical in terms of emissions, fault in the system has been recognized by the self-diagnosis, stored and is still present (static fault).

For production reasons:  
continued on the following  
coordinate.

### Notes:

1. As regards static faults, substitute values or substitute functions (where possible) are activated in the control unit, e.g. substitute variable for engine temperature in the case of defective engine-temperature sensor = 80 °C.  
Following recognition of fault elimination, the standard values or standard functions are re-employed, the fault lamp is switched off and the fault memory automatically cleared after 50 engine starts.
2. If an "important" fault is eliminated with the engine running, e.g. loose lambda-sensor plug connection reconnected, the fault lamp goes out after a delay time of roughly 5 seconds.

## SELF-DIAGNOSIS (continued)

### Flashing-code evaluation:

The flashing code for each fault consists of two flashing-pulse blocks. Each block represents a number and contains between 1 and 9 pulses. One pulse corresponds to the number 1, nine pulses correspond to the number 9. The fault lamp lights up briefly with each pulse. The pause between the blocks is longer than that between the individual pulses.

The respective flashing-code word (e.g. 52 = lambda closed-loop control outside range; see picture) is only output once.

The next fault is output by way of renewed stimulation.

All recognized faults are stored in the control unit in the sequence they occur.

### Activation of flashing-code diagnosis (fault output).

1. Switch on ignition\* (fault lamp comes on).
2. Effect stimulation for between 2.5 and 10 seconds, i.e. press button of evaluation unit (flashing code 1 2 = start of output appears).

Note:

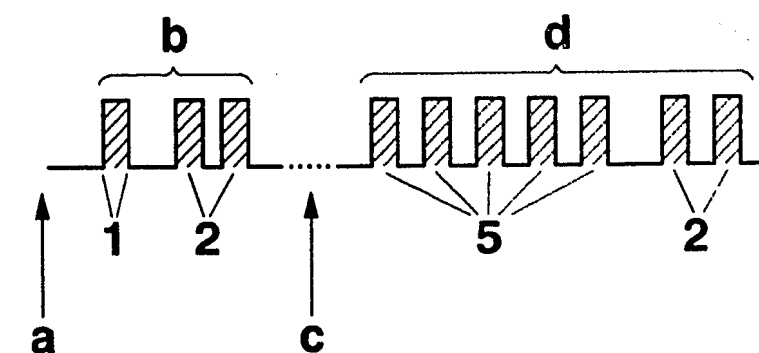
Following initial stimulation, the starting code 1 2 is always output first to confirm activation of the flashing-code diagnosis.

3. Effect stimulation again for between 2.5 and 10 seconds in order to read out the 1st fault (if present) etc. (Each flashing code is only output once until further stimulation).
4. The flashing code 1 1 appears to indicate "end of output" if all the stored faults have been output or immediately after the flashing code 1 2 if the fault memory is empty.
5. If, following flashing code 1 1, stimulation is again effected for between 2.5 and 10 seconds, the flashing-code output starts again with the start code 1 2.

If, on the other hand, the flashing-code output is to be terminated and the fault memory cleared, stimulation must be effected for more than 10 seconds after the flashing code 1 1.

Note: Flashing-code output can be terminated by switching off the ignition.

\* = Engine may also run ( $n < 2000 \text{ min}^{-1}$ )



KMK 125

- a = First stimulation
- b = Flashing code 12 →  
Start of output
- c = Second stimulation
- d = Flashing code 52 →  
Lambda control  
outside range

## SELF-DIAGNOSIS (continued)

### Clearing fault memory:

1. With system tester KTS 300 (clear command)
2. If stimulation is effected for more than 10 seconds following flashing code 1 1 = end of output
3. By interrupting continuous voltage supply (disconnect control unit or negative terminal of battery for approx. 1 minute)

### Note:

The fault memory should be cleared after eliminating the causes of trouble on the vehicle.

For production reasons:  
continued on the following  
coordinate.

## SELF-DIAGNOSIS (continued)

### Actuator diagnosis (actuator test):

#### Notes:

- Following first initiation (stimulation) of actuator diagnosis, the first component is continuously actuated by the control unit until stimulation is carried out again. The appropriate flashing-code word is output in this process by way of the fault lamp ("Check Engine").
- Each subsequent "stimulation process" activates actuation of the next component and the fault lamp with accompanying flashing-code word in a fixed sequence.
- "Stimulation process" signifies: press button of evaluation unit for between 2.5 and 10 seconds

### Activation of actuator diagnosis:

1. First stimulation process (flashing code 9 1 ):  
Start with stimulation even prior to switching on the ignition. During the stimulation process, switch on ignition and wait for at least 2.5 seconds; then terminate stimulation.  
Fault lamp goes out for roughly 2.5 seconds and subsequently flashes up "9 1". The lamp then lights up continuously.  
At the same time, the injection valves are periodically actuated until stimulation is effected again (audible).  
Caution! In the event of residual fuel pressure, fuel will be injected into the cylinders; this step is thus to be activated for the shortest possible time.
2. Second stimulation process (flashing code 9 2 ):  
Actuation of idle actuator (clearly audible)
3. Third stimulation process (flashing code 9 4 ):  
Actuation of tank-vent valve (TEV)  
(can be heard and felt)
4. Fourth stimulation process:  
Actuator diagnosis is repeated.

SELF-DIAGNOSIS TEST TABLE

Pocket system tester Fault indication	Fault code	Flash- ing code	Coor- dinate
Data exchange not possible	—	—	B21
Control unit Digital sec.(comput) defective	01	54	B23
Idle actuator ZWD Winding 1/EWD Op.circ/Ground short Short to B+	04	22	B25
Pressure sensor outside range	08	33	B27
Lambda control outside min. range outside max. range	10	52	C03
Idle actuator ZWD Winding 2 Op.circ/ground short Short to B+	22	22	B25
Lambda sensor Open circuit Short to ground Short to B+	28	51	C05

SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Pocket system tester Fault indication	Fault code	Flash- ing code	Coor- dinate
Battery voltage too low too high	37	53	C07
Ref.-mark signal outside range	42	41	C09
Air-temp. sensor Op.circ./sh. to B+ Short to ground	44	13	C15
Engine temp. sensor Op.circ./sh. to B+ Short to ground	45	14	C19
Throttle-valve signal Signal too high Signal too low	54	21	C23
No fault stored		—	—
—	—	11	B13

# SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM ( 1 )

TESTER FAULT CODE: —  
"Exchange of data not possible"  
(FLASHING CODE: —)

Prerequisites for data exchange  
between control unit and tester/  
flashing-code output:

1. Voltage supply and ground  
of Motronic control unit  
O.K.
2. The following diagnosis-  
plug connections must be  
in perfect condition:  
Connection A to control unit  
term. 04 (stimulation lead),  
connection B to control unit  
term. 12 (serial interface),  
connections C / D → voltage  
supply for tester (12 V).
3. Fault lamp and leads O.K.  
(flashing code).
4. Control unit O.K.

Exchange of data/flashing-  
code output possible ?

N>

\*Measure voltage supply of control  
unit:

Battery voltage with respect to  
term. 05 (ground) must always be  
present at control-unit plug  
term. 18 (continuous positive)  
and at term. 35 when the ignition  
is switched on.

If there is no voltage present:

1. Check corresponding leads in  
accordance with terminal dia-  
gram for open circuit and short  
circuit.
2. Check main relay.

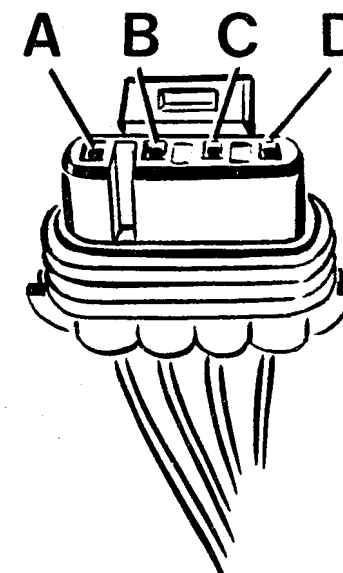
\*It must not be possible to push  
back spring contacts in control-  
unit plug or in diagnosis plug.

\*Has tester been properly connected  
and operated ?  
(Pay attention to operating  
instructions for KTS 300)

\*Is universal adapter lead O.K. ?

\*Does the tester feature the  
prescribed program module ?

If no faults were established,  
repeat communication build-up  
process and replace control unit  
if necessary.

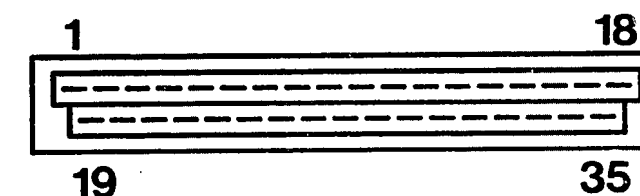


KMK 00123

Diagnosis plug:

- A = Stimulation lead
- B = Serial interface
- C = +12 V (term. 30)
- D = Ground

Top view of 35-pin  
control-unit plug of  
Motronic wiring harness



KMK 00126

Return to self-diagnosis  
test table B19

# SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM ( 2 )

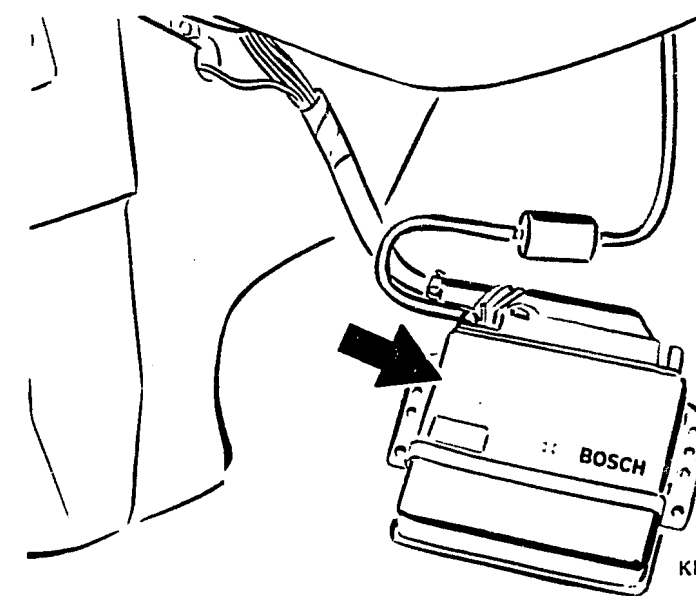
TESTER FAULT CODE: 01  
(FLASHING CODE: 54)

Self-test of digital section  
(program memory) in control  
unit.

Tester code/flashing code  
not present ?

N>

1. Clear fault memory and  
interrogate self-diagnosis  
again.
2. Replace control unit if tester  
code 01 or flashing code 52  
is repeatedly output.



Return to self-diagnosis  
test table B19

B23



B24





# SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM ( 3 )

TESTER FAULT CODE: 04 / 22  
(FLASHING CODE: 22)

Test idle actuator with the aid of actuator diagnosis. Activate actuator diagnosis as described in Section "Self-diagnosis".

With flashing code 92, idle actuator should be periodically actuated (audible).

Actuation of idle actuator clearly audible ?

N>

\*Detach 3-pole plug to actuator and measure winding resistances directly at idle actuator.

SET VALUES:

see brief instructions

If necessary, renew actuator. Pay attention to direction of flow.

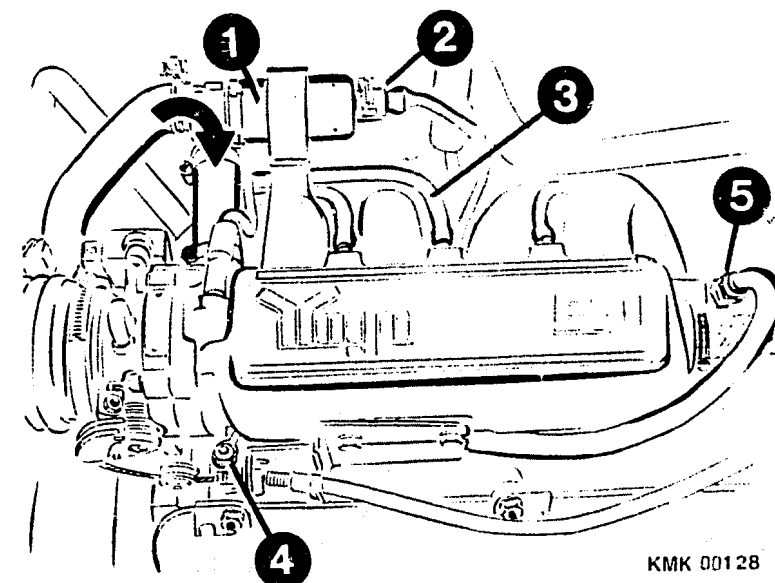
\*With ignition switched on, battery voltage (with respect to ground) must be present at center connection of idle actuator (term. 4), otherwise check continuity of center lead to main relay term.87 (+).

\*Rotary slider of idle actuator must not stick or catch. If necessary, renew actuator. Pay attention to direction of flow.

\*Check plug for corrosion and loose contacts. It must not be possible to push back spring contacts.

\*Check leads from control unit term.33 /34 to idle actuator term.5 /3 for continuity and short circuit (watch out for worn insulation).

\*Repeat activation of actuator diagnosis. Renew control unit if idle actuator is not actuated.



KMK 00128

1 = Idle actuator

2 = Plug

Arrow = Direction of flow

Return to self-diagnosis test table B19

TESTER FAULT CODE: 08  
(FLASHING CODE: 33)

Pressure-sensor signal  
outside range.

1. Pressure-sensor vacuum  
hose dropped off or  
kinked ?

Check connections at  
intake manifold, at pulsa-  
tion damper and at control  
unit (see pictures).

2. Check pressure-sensor  
vacuum hose and pulsation  
damper for leakage and  
blockage:

\*To check for blockage,  
detach vacuum hose at  
control unit and intake  
manifold and connect  
vacuum pump (e.g. Mityvac)  
to intake-manifold end.  
If there is no blockage,  
it will not be possible  
to build up a vacuum.

\*To perform leak test,  
re-connect vacuum hose  
at control unit.

Generate vacuum of approx.  
0.5 bar. If there are no  
leaks in the vacuum hose  
(and pressure sensor), there  
must be no reduction in  
vacuum.

3. Check air-intake system  
for leaks.

Pressure-sensor vacuum hose,  
pulsation damper and induction  
system O.K. ?

N>

1. Re-connect vacuum hose/check  
hose routing.

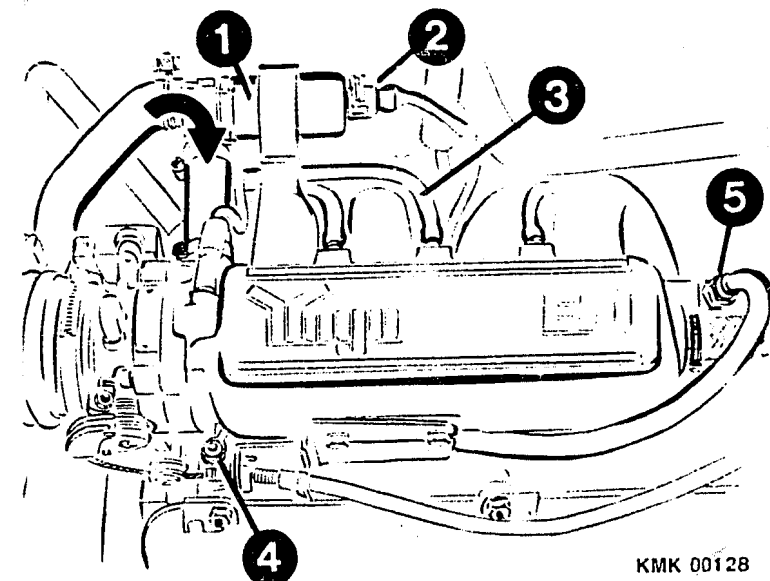
2. Vacuum hose damaged or porous  
—> renew.

Notes:

-In the event of moisture, use gun  
to blow compressed air through  
hose and pulsation damper.

-If the negative pressure is  
totally dissipated in the course  
of the leak test despite the  
fact that there is nothing wrong  
with the vacuum hose, there is  
a leak in the pressure sensor  
(in the control unit) —> renew  
control unit.

3. Eliminate leakages in air-  
intake system by way of new  
seals or by tightening screws/  
tie bands.

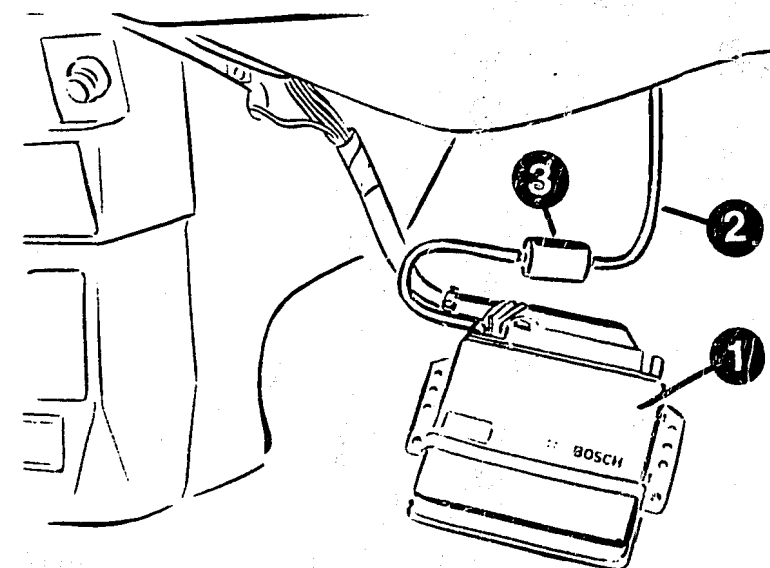


KMK 00128

3 = Vacuum hose from intake  
manifold to pressure sensor  
in control unit

1 = Motronic control unit  
2 = Vacuum hose from intake  
manifold to pressure  
sensor in control  
unit

3 = Pulsation damper



KMK 00116

Continued on next picture page

V

In view of the fact that the pressure sensor is installed in the control unit, it cannot be electrically tested and can therefore only be replaced together with the control unit in the event of a fault.

If incorrect diagnosis and thus unnecessary control-unit replacement are to be avoided, the pressure-sensor vacuum hose and the freedom from leaks of the air-intake system must be checked painstakingly in the event of fault code 08 (flashing code 33).

In cases of doubt, clear fault memory and perform test drive.

If the fault lamp lights up continuously during the test drive and if fault code 08 (flashing code 33) is again output during subsequent interrogation of the self-diagnosis, the pressure sensor is defective, replace control unit.

Y

V

Return to self-diagnosis  
test table B19

# SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM ( 5 )

TESTER FAULT CODE: 10  
(FLASHING CODE: 52)

Lambda control outside range.

Possible sources of fault:

\*Contact resistances at Motronic ground terminals  
\*Leak in air-intake system or exhaust system

\*Fuel pressure/delivery of electric fuel pump outside tolerance

\*Defective injection valves

\*Lambda sensor defective (incorrect signal e.g. due to leading or mechanical damage).

\*Pressure sensor (control unit) defective

\*Tank ventilation defective

\*Fuel tank run empty (clear fault memory)

Connect lambda-control tester to one-pole sensor plug connection.

With engine at operating temperature (and sensor), measure sensor voltage whilst idling or at slightly higher speed.

SET VALUE: Pointer fluctuates around approx. 450 mV

(CO content with engine and catalytic converter at operating temperature

0...0.2 vol.%)

Indicated items O.K. ?

N>

\*In the event of sensor voltage less than 0.3 V :

-Check air-intake system for leaks.

-Deposits on injection valves (renew if necessary)

-Inadequate fuel pressure/delivery of electric fuel pump. See brief instructions for set values.

-Lambda sensor leaded due to use of (including temporary use of) leaded fuel

Result: low sensor voltage despite correct air/fuel mixture → control unit effects enrichment.

Renew lambda sensor.

\*In the case of sensor voltage greater than 0.6 V :

-Eliminate contact resistances at Motronic ground terminals

-Fuel pressure too high (e.g. intake-manifold-pressure connection of pressure regulator dropped off or leaking)

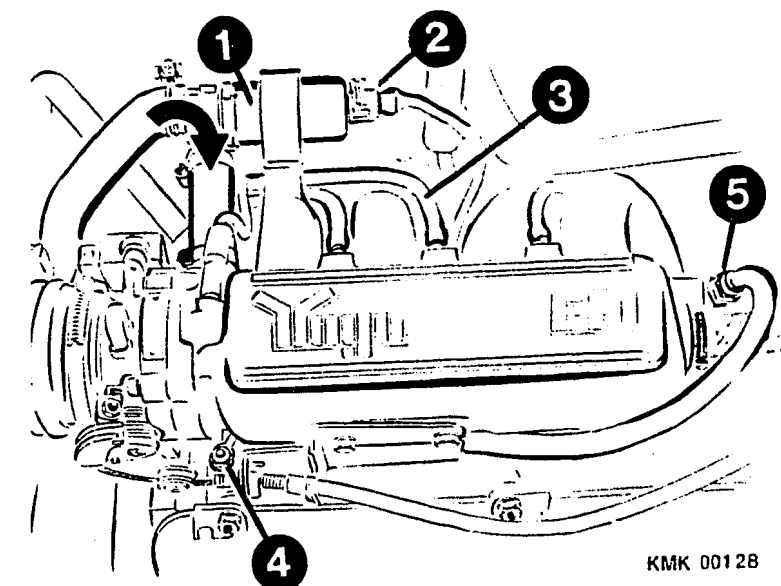
-Leaking injection valves (renew)

-Check tank-vent valve (TEV).

-Eliminate leaks in exhaust manifold

N o t e :

Despite correct sensor voltage when idling, mixture deviations may cause the lambda closed-loop control to move onto its stop in other engine operating statuses.



KMK 00128

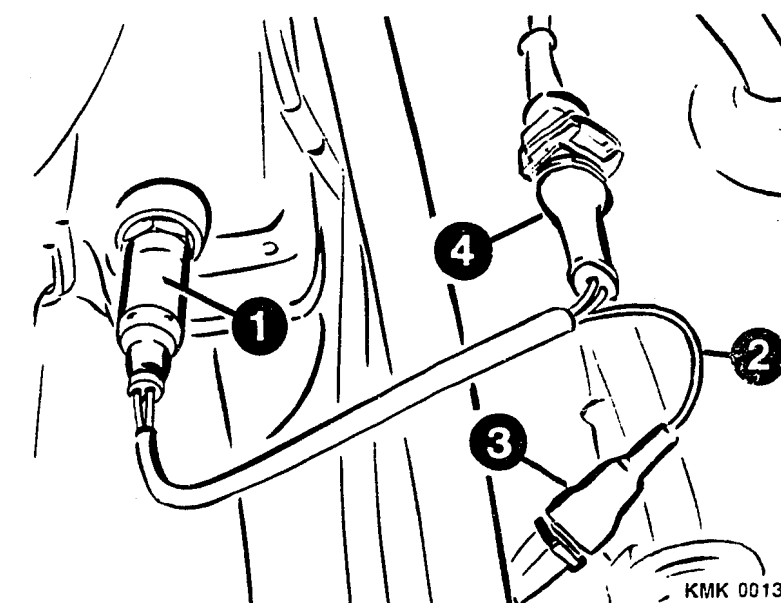
4 = Motronic ground connection  
(Term. 05 / 08 / 16)

1 = Heated lambda sensor

2 = Signal lead (black)

3 = One-pole sensor plug connection (to control unit term. 24)

4 = Two-pole plug connection for sensor heater



KMK 00130

Return to self-diagnosis  
test table B19

# SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM ( 6 )

TESTER FAULT CODE: 28  
(FLASHING CODE: 51)

N>

Lambda sensor not functioning properly.

\*Check one-pole sensor plug connection for corrosion and loose contact.

\*Check signal lead from 1-pole sensor plug to control-unit plug term.24 for open circuit, short circuit to ground or live lead.

\*Check sensor heater in the case of models with heated lambda sensor:

To do so, disconnect 2-pole plug connection to sensor (bottom picture) and measure resistance at sensor plug

SET VALUE: 1...15  $\Omega$   
(temperature-dependent)

Measure voltage at mating plug

SET VALUE: battery voltage

\*Connect lambda-control tester to 1-pole sensor plug connection. With engine at operating temperature (and sensor), measure sensor voltage whilst idling or at slightly higher speed.

SET VALUE: Pointer fluctuates around approx. 460 mV

Plug, lead, sensor heater (if applicable) and sensor voltage O.K. ?

\*Repair single-pole sensor plug connection/signal lead.

\*Renew lambda sensor in the event of defective heater winding (if sensor heated).

\*In the event of incorrect sensor voltage, repeat measurement after clearing adaption (switch off engine, disconnect negative terminal of battery for approx. 1 minute).

If correct sensor voltage is still not obtained, detach sensor heater (if provided).

If sensor voltage is then O.K., renew lambda sensor.

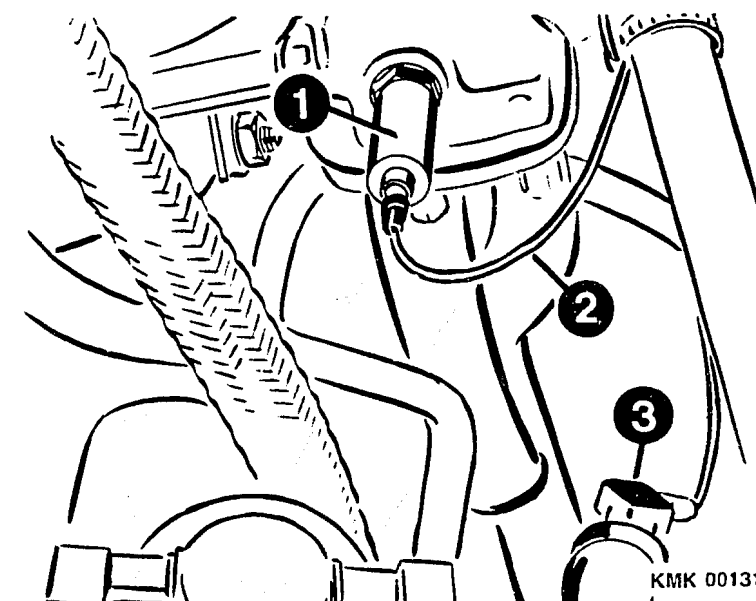
\*Note:

Lambda sensor may also be defective due to the use of (including temporary use of) leaded fuel or as a result of mechanical damage.

Renew sensor in case of doubt.

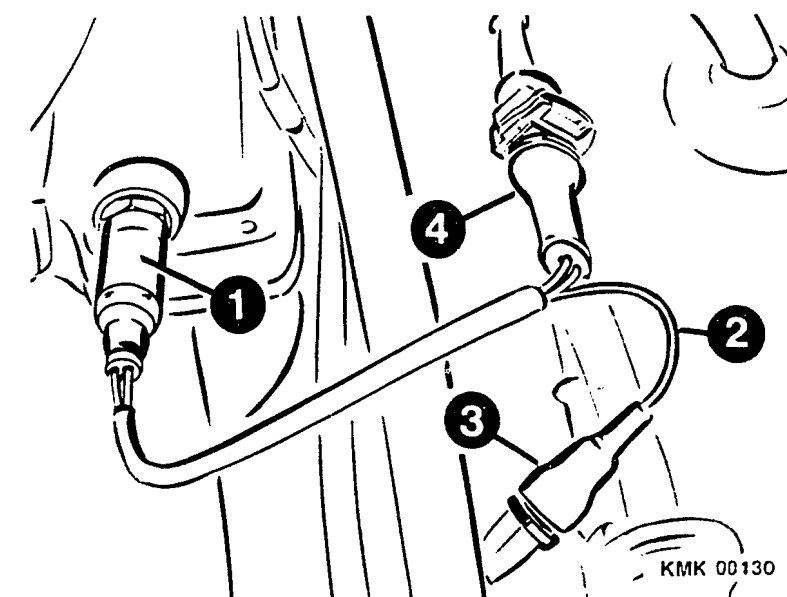
## NOTES ON SENSOR INSTALLATION:

Prior to installation, coat sensor thread with mounting paste VS 14016 Ft. Make sure that no paste gets into slits in protective conduit. Part number of mounting paste: 5 964 080 112  
Connect sensor plug.  
Do not use contact spray.



- 1 = Non-heated lambda sensor
- 2 = Signal lead
- 3 = One-pole sensor plug connection (to control unit term. 24)

- 1 = Heated lambda sensor
- 2 = Signal lead (black)
- 3 = One-pole sensor plug connection (to control unit term. 24)
- 4 = Two-pole plug connection for sensor heater



Return to self-diagnosis  
test table B19

# SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM ( 7 )

V

TESTER FAULT CODE: 37  
(FLASHING CODE: 53)

N>

Voltage supply for control unit  
outside tolerance

1. Voltage at control unit term. 18  
(+) and term. 05 (-) less than  
10 V with engine running:

\*Check voltage dips (contact  
resistances) at ground terminal  
and positive lead.

\*Terminals and plug connections  
must be bright and corrosion-  
free.

\*Check positive terminals  
affected:

At main relay term. 87 and  
term. 30 as well as at battery  
terminal B+ and ignition lock  
term. 15.

\*Check main relay.

\*Check battery charge.

2. Voltage at control unit term. 18  
(+) and term. 05 (-) greater  
than 16 V with engine running:

\*Check alternator regulator.

Voltage dips eliminated ?

Main relay in perfect working order?

Battery adequately charged?

Alternator regulator O.K. ?

Y  
V

Return to self-diagnosis  
test table B20

1). If voltage too low:

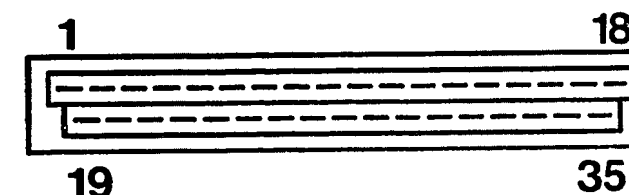
\*Eliminate defects at terminals;  
renew plug connections  
if necessary.

\*Replace main relay.

\*Charge battery.

2). If voltage too high:

\*Replace alternator regulator.



KMK 00126

Top view of 35-pin  
control-unit plug of  
Motronic wiring harness

# SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM ( 8 )

TESTER FAULT CODE: 42  
(FLASHING CODE: 41)

Reference-mark signal outside range.

Check signal from engine-speed/reference-mark sensor:

\*Disconnect sensor plug connection (top picture, arrow)

\*Set engine tester to special input

\*Lever on left-hand stop (calibrated voltage range)

\*Connect special cable to sensor plug; red tester terminal to term.1(A) of sensor plug, black tester terminal to term.2(B) (negative, center contact). See center picture.

\*Start engine.

SET VALUE: see bottom picture

1 = Engine-speed signal

2 = Reference-mark signal

\*Read off voltage magnitude.

Note:

With the reference-mark signal, the negative amplitude must appear first.

Signal O.K. ?

N>

1.No signal or signal too low:

\*Measurement leads incorrectly connected; correct in accordance with terminal diagram.

\*Check internal resistance of engine-speed/reference-mark sensor:

Disconnect sensor plug connection and connect ohmmeter to sensor plug at term.1(A) and term.2(B).

SET VALUE: see brief instructions

\*Check insulation resistance of engine-speed/reference-mark sensor:

Connect ohmmeter to sensor plug between term.2(B) and term.3(C)

SET VALUE: infinity  $\Omega$

\*Cranking speed less than 200 min<sup>-1</sup>, charge battery.

\*Sensor air gap too large (sensor tight and inserted as far as stop ?).

SET VALUE: 0,8 mm  $\pm$  0.5

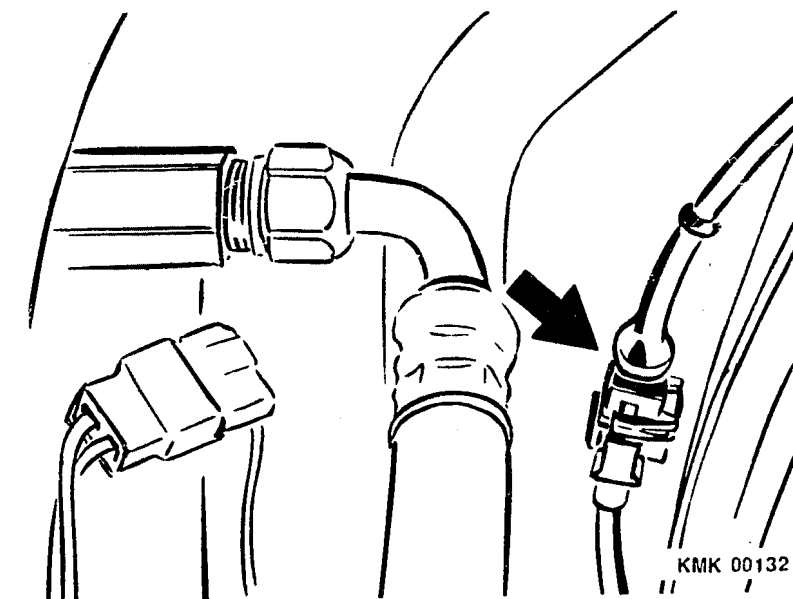
\*Mechanical defect in sensor.

Note:

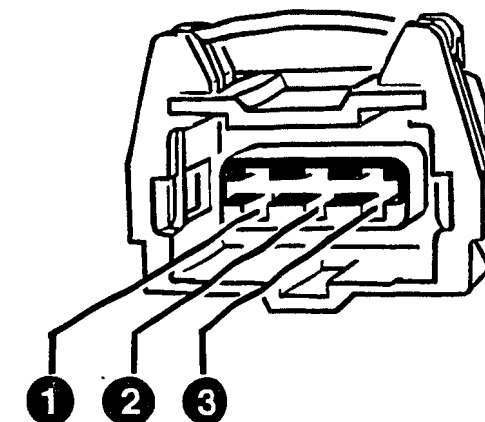
In the event of incorrect resistance value or mechanical sensor damage, pay attention to following information on sensor replacement.

2.Faulty signal:

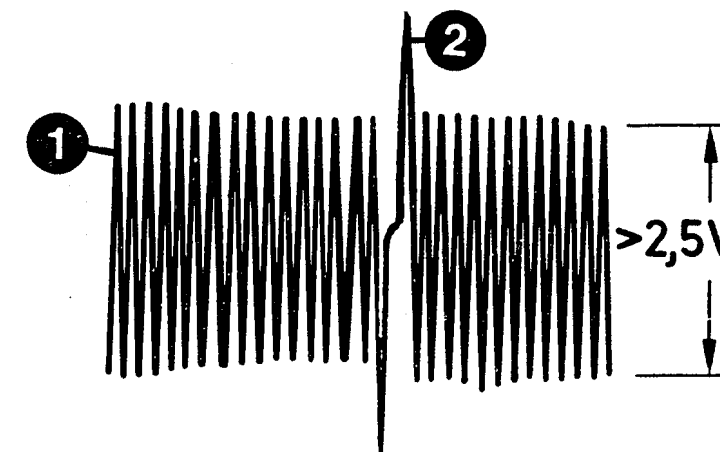
\*Sensor disk dirty or damaged.



KMK 00132



KMZ 00021



KMK 00133

Continued on next picture page

Continued on next picture page

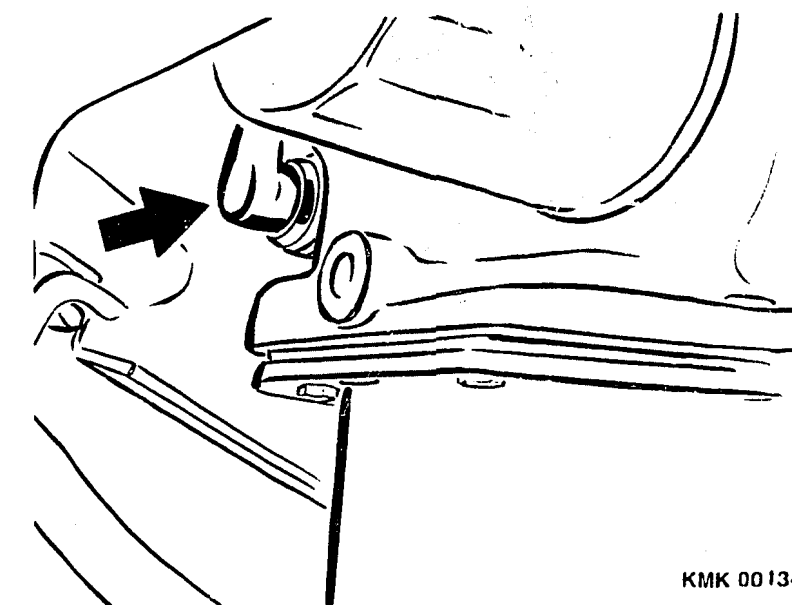
Sensor defective → replace.

Notes on replacement:

Unscrew fastening screw and withdraw sensor. If stiff, help by turning and with screwdriver.

Do not take sensor out of protective sleeve until just before installation.  
Before installing the sensor, make sure that there are no metallic parts sticking to the sensor (sensors contain permanent magnets).  
Grease sensor with Longterm 2.  
Press sensor by hand into the hole as far as it will go. Do not use force. Do not knock.  
Make sure that the spring contacts in the plug are correctly seated. Spring contacts must not allow themselves to be pushed back and must be free from corrosion. Plug connector must latch in.

Arrow = Engine-speed/  
reference-mark sensor



KMK 00134

Continued on next picture page

Return to self-diagnosis  
test table B20



SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM ( 8 ) CONTINUED ( 2 )

Check the following leads for open circuit with ohmmeter:

From control-unit plug term. 25 to sensor plug connector term. 1(A) and from control-unit plug term. 23 to sensor plug connector term. 2(B).

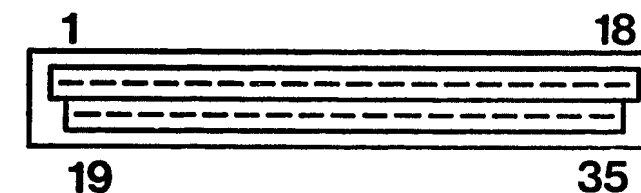
Set values: approx. 0  $\Omega$

Check plug for corrosion and loose contact.  
Contacts must not allow themselves to be pushed back.

Set values obtained?  
Contacts O.K.?

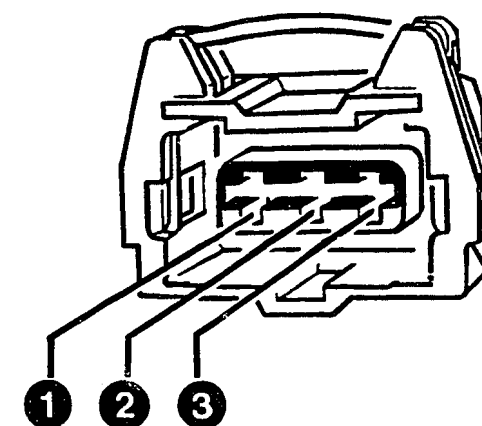
Repair defective lead/plug.

Return to self-diagnosis test table B20



KMK 00126

Top view of 35-pin control-unit plug of Motronic wiring harness



KMZ 00021

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM ( 9 )

TESTER FAULT CODE: 44  
(FLASHING CODE: 13)

Check temperature sensor (air) in  
intake manifold:

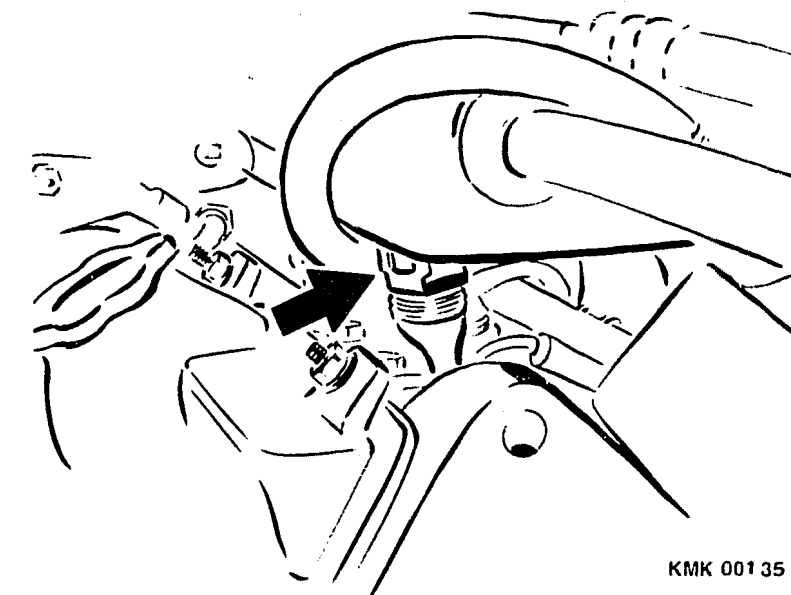
Detach plug of temperature sensor  
(arrow in picture).  
Test resistance value directly at  
temperature sensor.  
(Use test lead 1 684 463 093).

SET VALUE:  
see brief instructions

Is set value attained ?

N>

Renew temperature sensor.



Continued on next picture page

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM ( 9 ) CONTINUED ( 1 )

↓  
V  
Visually inspect plug of temperature sensor:

Plug properly connected, contacts corroded? Spring contacts must be engaged and it must not be possible to push them back.

Is plug O.K.?

N>

Eliminate defects on plug.  
If necessary, replace plug  
or spring contacts.

Y

↓  
V  
Using ohmmeter, check leads to temperature sensor for open circuit and short circuit. From temperature-sensor plug to control-unit plug term. 22 and to vehicle ground.

Leads O.K.?

N>

Eliminate contact resistances, open circuits or short circuits on leads.

Y

↓  
V  
Return to self-diagnosis test table B20

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (10)

TESTER FAULT CODE: 45  
(FLASHING CODE: 14)

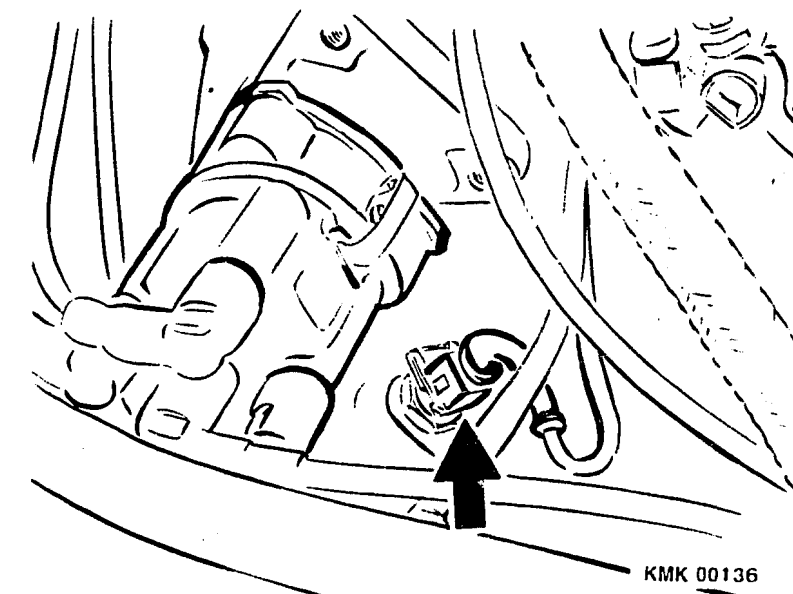
N>

Renew temperature sensor.

Check temperature sensor (engine):  
Detach plug from temperature  
sensor.  
Test resistance value directly at  
temperature sensor.

SET VALUE:  
see brief instructions

Is set value attained ?



Arrow = Temperature sensor  
(engine)

Continued on next picture page

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (10) CONTINUED ( 1 )

V

Visually inspect plug of temperature sensor:

N>

Plug properly connected, contacts corroded? Spring contacts must be engaged and it must not be possible to push them back.

Is plug O.K.?

Eliminate defects on plug.  
If necessary, replace plug  
or spring contacts.

Y

V

Using ohmmeter, check leads to temperature sensor for open circuit and short circuit. From temperature-sensor plug to control-unit plug term. 13 and to vehicle ground.

N>

Leads O.K.?

Eliminate contact resistances, open circuits or short circuits on leads.

Y

Return to self-diagnosis  
test table B20

# SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (11)

TESTER FAULT CODE: 54  
(FLASHING CODE: 21)

N>

Signal of throttle-valve sensor too high or too low.

1. Test resistances of throttle-valve potentiometer:

\*Switch off ignition.

\*Detach 3-pole potentiometer plug.

\*Measure resistance values directly at plug pins of sensor.  
SET VALUES:

See brief instructions.

2. Determine voltages at throttle-valve potentiometer:

\*Re-connect 3-pole potentiometer plug.

\*Switch on ignition

\*Push back rubber sleeve at plug and measure voltage with suitable test prods.

SET VALUES:

See brief instructions

Are set values attained?

1. Resistance values are not attained:  
Renew throttle-valve sensor.

2. Voltage set values are not attained:

\*Perform visual inspection at plug of throttle-valve sensor.  
Plug properly connected?

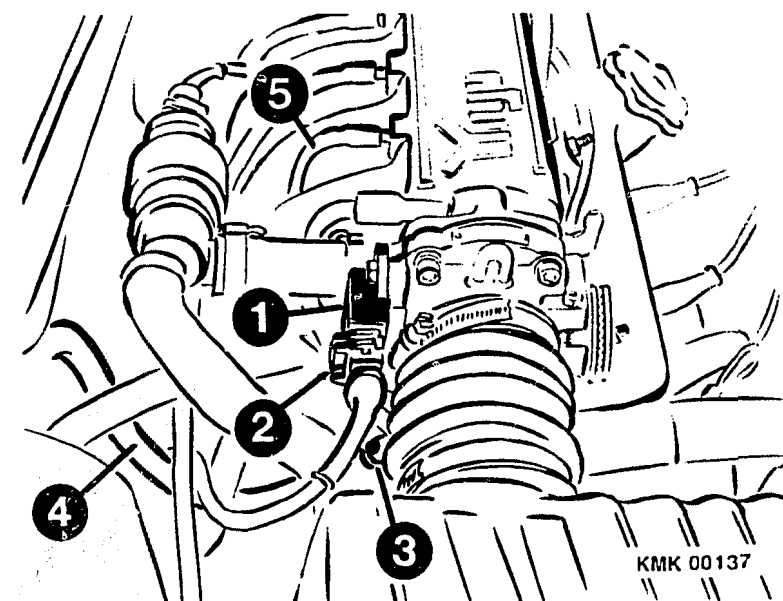
Contacts corroded?

Spring contacts must be engaged and it must not be possible to push them back.

\*Use ohmmeter to check leads from throttle-valve sensor to control-unit plug for open circuits, short circuits to ground (insulation damage) and faulty connections. Watch out for worn insulation and loose contacts.

Proceed in accordance with terminal diagram in brief instructions.

\*If all leads are O.K., control unit is defective and must be renewed.



1 = Throttle-valve sensor

2 = 3-pole plug to sensor

Return to self-diagnosis  
test table B20

# TROUBLE-SHOOTING PROGRAM ( 1 )

\* Check power supply to control unit:

Switch off ignition.

Disconnect control-unit plug (top picture).

Connect voltmeter to disconnected control-unit plug term. 35 and term. 5.

Switch on ignition.

SET VALUE: Battery voltage

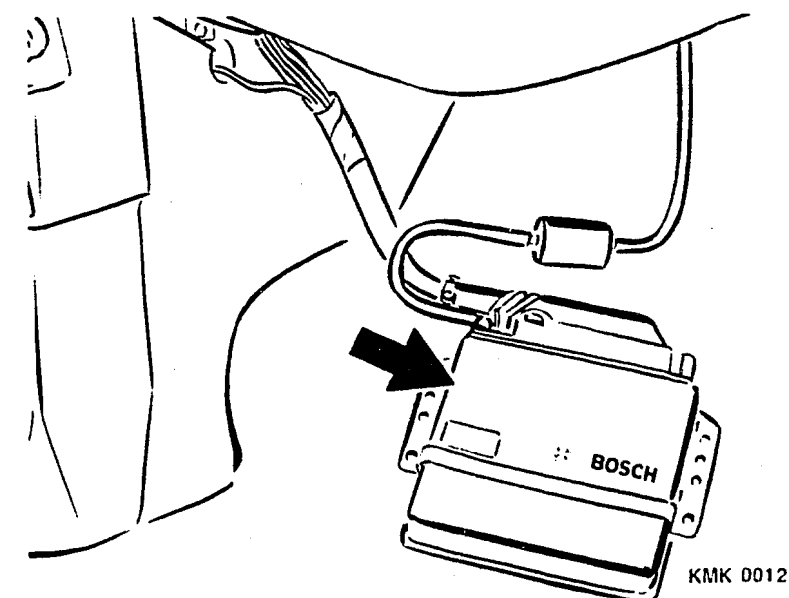
Set value obtained?

Return to trouble-shooting chart B03

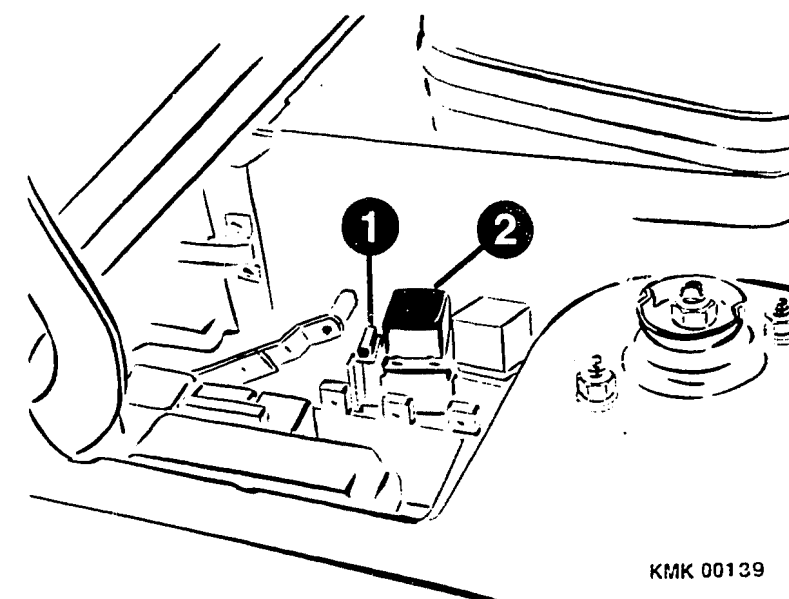
1. Check fuse next to main relay
2. Switch off ignition.  
Connect ohmmeter to detached control-unit plug term.5 with respect to vehicle ground.  
Ohmmeter must indicate approx. 0  $\Omega$  (continuity), otherwise eliminate open circuit or contact resistance at ground terminal.
3. Check following lead for continuity:  
From control unit term.35 to main relay term.87.
4. Measure voltages at main relay:

\*Detach main relay and connect voltmeter to frame term.86 and term.85.  
Switch on ignition.  
Voltmeter must indicate battery voltage.  
If this is not the case, check leads from ignition lock term.15 to relay term.86 and from relay term.85 to ground terminal for continuity.  
\*Connect voltmeter to relay frame term.30 and term.85.  
Battery voltage must be measured.  
If this is not the case, check lead to battery positive terminal.

5. Main relay defective, renew



- 1 = Fuse next to main relay  
2 = Main relay



# TROUBLE-SHOOTING PROGRAM ( 2 )

Check signal from engine-speed/  
reference-mark sensor:

- \*Disconnect sensor plug connection (top picture, arrow)
- \*Set engine tester to special input
- \*Lever on left-hand stop (calibrated voltage range)
- \*Connect special cable to sensor plug; red tester terminal to term.1(A) of sensor plug; black tester terminal to term.2(B) (negative, center contact). See center picture.
- \*Start engine.

SET VALUE: see bottom picture  
1 = Engine-speed signal  
2 = Reference-mark signal

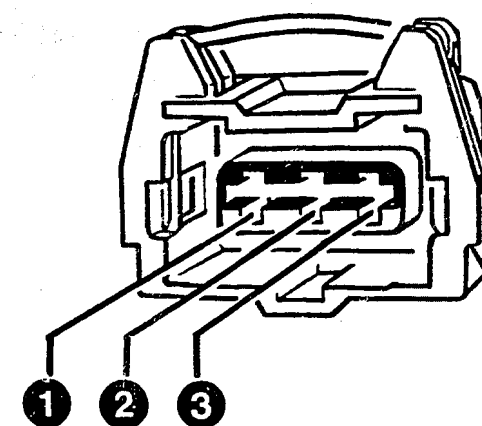
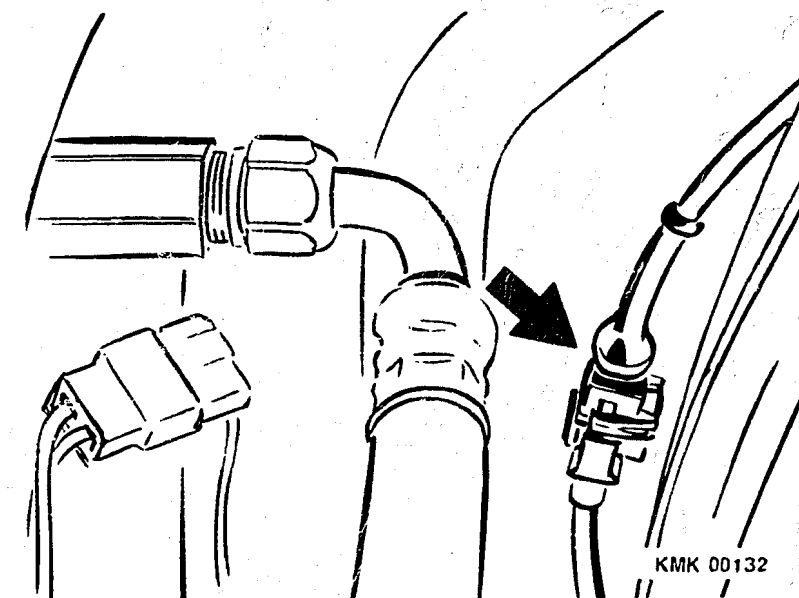
\*Read off voltage magnitude.

**N o t e :**  
In the case of reference-mark sensor, negative amplitude must appear first.

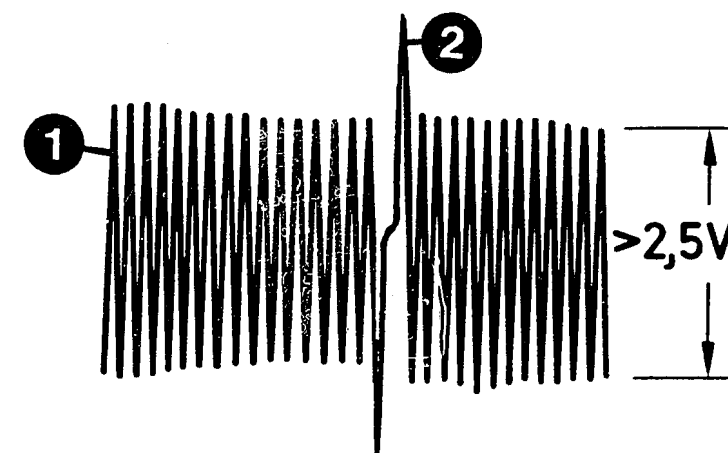
Signal O.K. ?

N>

- 1.No signal or signal too low:
  - \*Measurement leads incorrectly connected; correct in accordance with terminal diagram.
  - \*Check internal resistance of engine-speed/reference-mark sensor:  
Disconnect sensor plug connection and connect ohmmeter to sensor plug at term.1 and term.2.  
SET VALUE: see brief instructions
  - \*Check insulation resistance of engine-speed/reference-mark sensor:  
Connect ohmmeter to sensor plug between term.2 and term.3  
SET VALUE: infinity  $\Omega$
  - \*Cranking speed less than 200 min<sup>-1</sup>, charge battery.
  - \*Sensor air gap too large (sensor tight and inserted as far as stop ?).  
SET VALUE: 0,8 mm  $\pm$  0.5
  - \*Mechanical defect in sensor.  
Note:  
In the event of incorrect resistance value or mechanical sensor damage, pay attention to following information on sensor replacement.
- 2.Faulty signal:
  - \*Sensor disk dirty or damaged.



KMZ 00021



KMK 00133

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Continued on next picture page

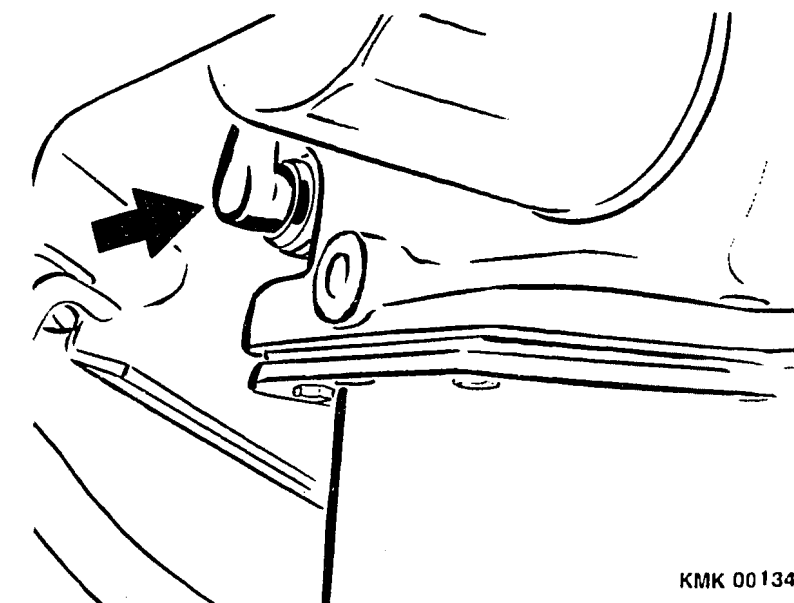


Sensor defective -> replace.

Notes on replacement:

Unscrew fastening screw and withdraw sensor. If stiff, help by turning and with screwdriver.

Do not take sensor out of protective sleeve until just before installation. Before installing the sensor, make sure that there are no metallic parts sticking to the sensor (sensors contain permanent magnets). Grease sensor with Longterm 2. Press sensor by hand into the hole as far as it will go. Do not use force. Do not knock. Make sure that the spring contacts in the plug are correctly seated. Spring contacts must not allow themselves to be pushed back and must be free from corrosion. Plug connector must latch in.



KMK 00134

Arrow = Engine-speed/  
reference-mark sensor

Continued on next picture page

Return to trouble-shooting chart  
B03

TROUBLE-SHOOTING PROGRAM ( 2 ) CONTINUED ( 2 )

V

Check the following leads for open circuit with ohmmeter:

From control-unit plug term. 25 to sensor plug connector term. 1(A) and from control-unit plug term. 23 to sensor plug connector term. 2(B).

Set values: approx. 0  $\Omega$

Check plug for corrosion and loose contact.  
Contacts must not allow themselves to be pushed back.

Set values obtained?  
Contacts O.K.?

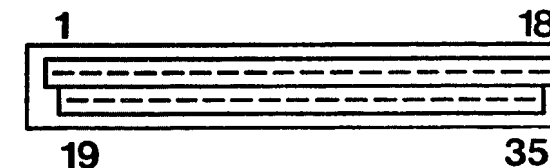
N>

Repair defective lead/plug.

Y

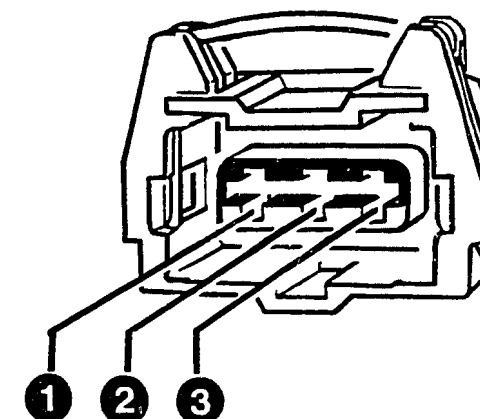
Return to trouble-shooting chart B03

V



KMK 00126

Top view of 35-pin control-unit plug of Motronic wiring harness



KMZ 00021

# TRUBLE-SHOOTING PROGRAM ( 3 )

Check primary signal with oscilloscope:

Connect oscilloscope to ignition coil.

Connect Motronic control unit.

Disengage gear and start engine.

SET VALUE:

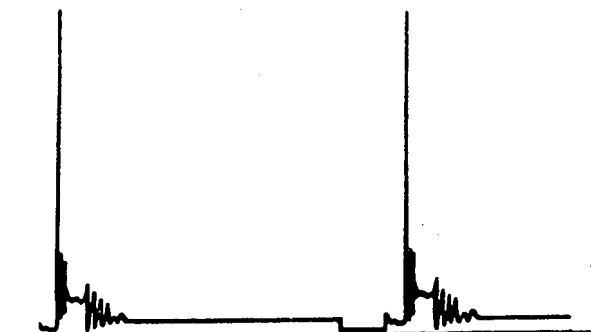
Primary signal must be present (see top picture).

Primary signal present?

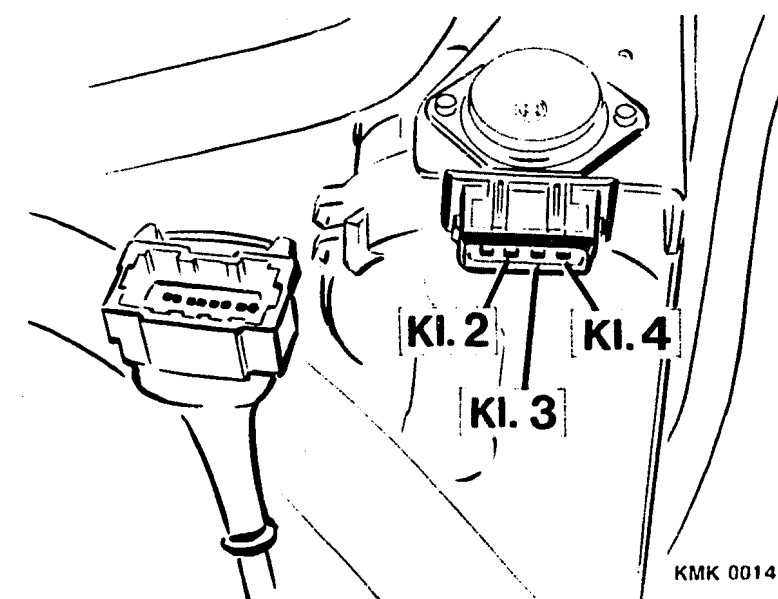
N>

1. Battery voltage present at ignition coil term. 1 with ignition switched on ?  
If this is not the case, check ignition coil and lead to ignition coil term. 15 in accordance with terminal diagram.

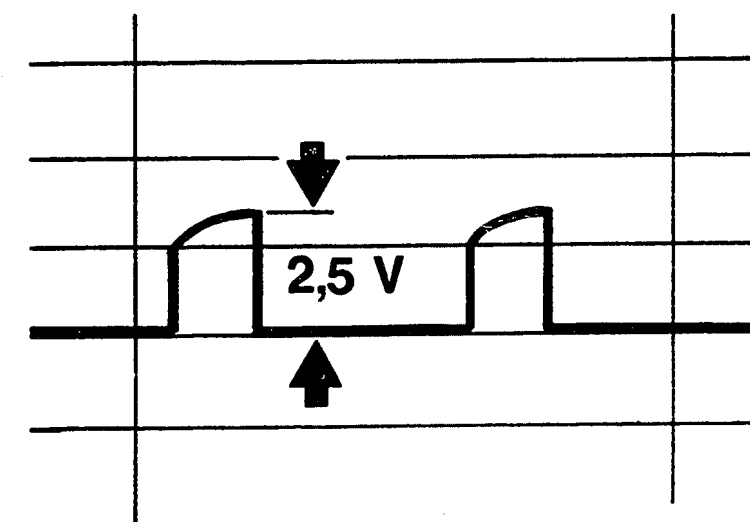
2. Check actuation and supply voltage of ignition trigger box:  
\*Switch off ignition, push back rubber sleeve at ignition-trigger-box plug, do not disconnect plug.  
Connect oscilloscope measurement leads (special input); black clip to vehicle ground, red clip with suitable test prod at rear to plug term. 4. See center picture.  
Start engine.  
SET VALUE: pulses as in lower picture with min. 2.5 V voltage magnitude.



KMZ 00022



KMK 00140



KMK 00141

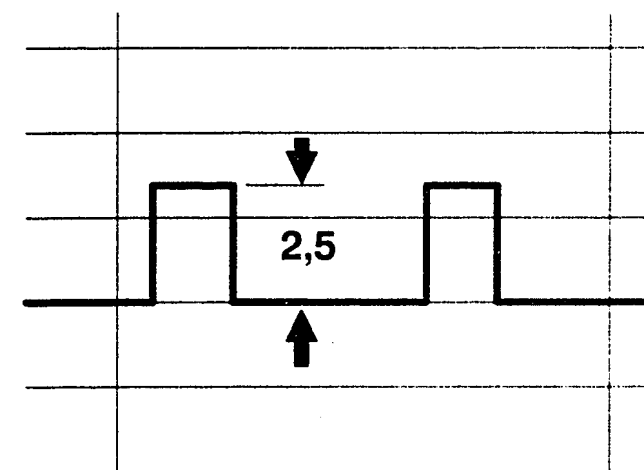
Return to trouble-shooting chart B03

Continued on next picture page

V

\*If no pulses present:  
Battery voltage must be present  
between term. 3 and 2 in plug  
with ignition switched on;  
otherwise check leads in  
accordance with terminal  
diagram.  
Switch off ignition, detach  
ignition-trigger-box and  
control-unit plugs, and check  
actuation lead for continuity  
and short circuit between  
Motronic term. 1 and trigger  
box term. 4.  
Re-attach control-unit plug and  
connect up resistor with 220  
ohms between term. 4 and 2  
(ground) in detached trigger-  
box plug.  
Start engine and observe signal.  
SET VALUE:  
Rectangular signal with an ampli-  
tude of at least 2.5 V (top  
picture).

If set value is not attained,  
control unit is defective →  
replace.  
If set value is attained,  
ignition trigger box is defect-  
ive → replace.



KMK 142

V

Return to trouble-shooting chart  
B03

# TROUBLE-SHOOTING PROGRAM (4 )

## Check ignition coil.

### Visual check:

Remove hood from ignition coil and check that plug (top picture) is in position and that no sealing compound has escaped.

### Electrical test:

Measure resistance of ignition coil on primary side (term.15 and term.1; take resistance of test lead and test prods into account) and on secondary side (term.1 and term.4):

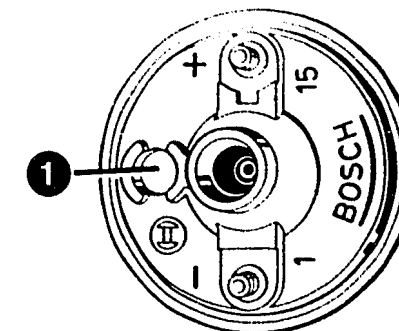
SET VALUES:  
see brief instructions

Plug in position and no sealing compound escaped?

Resistance values O.K.?

N>

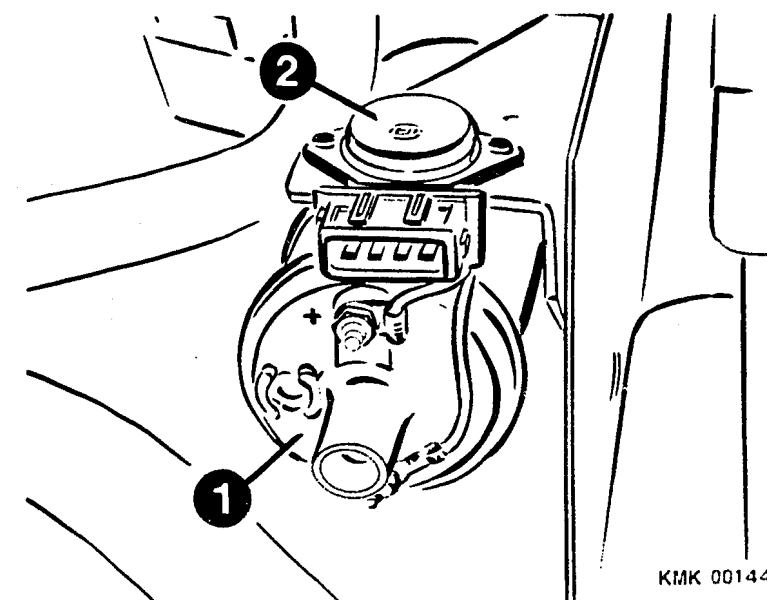
1. Plug not present or sealing compound oozed out:  
\*Renew ignition coil with ignition trigger box.
2. Resistance values outside tolerance:  
\*Renew ignition coil.



KMZ 00034

1 = Plug

1 = Ignition coil  
2 = Ignition trigger box



KMK 00144

Return to trouble-shooting chart  
B03

D09

<=>

D10

<=>

TRUBLE-SHOOTING PROGRAM ( 5)

V

Check secondary patterns of  
all cylinders and interference-  
suppression resistors.

N>

SET VALUES for interference-  
suppression resistors:  
see brief instructions

Secondary patterns and inter-  
ference-suppression resistors O.K.?

Y

\*Outside and/or inside of  
distributor cap oil fouled?  
Scorch marks visible?

\*Check interference-suppression  
resistors, ignition cables  
and spark plugs.

\*When plugging on the ignition  
cables, note the cylinder  
numbers.  
Do not forget hood and  
screening cover.

Return to trouble-shooting chart  
B03

D11

<==>

D12

<==>

## TROUBLE-SHOOTING PROGRAM ( 6 )

Checking solenoid-operated injection valves with the aid of actuator diagnosis.

Activate actuator diagnosis as described in Section "Self-diagnosis".

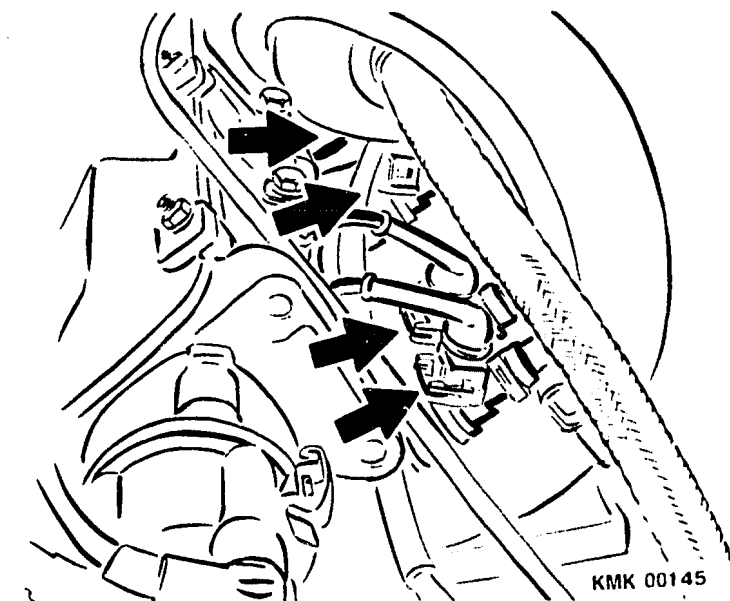
With flashing code 91, injection valves should be audibly pulsed (top picture).  
In order to check the injection valves individually, only leave one valve connected in each case (detach all other injection-valve plugs).

1. Pulsing of injection valves clearly audible ?
2. All valves O.K. ?

N>

\* Test for continuity in positive leads from injection valves to main relay term. 87 and in negative leads to control unit term. 14.  
Spring contact no. 14 in control-unit plug O.K.?  
It must not be possible to push it back.

\* Test solenoid-operated injection valve with ohmmeter.  
Set value: 14,5...20  $\Omega$   
If applicable, renew defective injection valve  
Note:  
A valve may be defective (mechanical defect) despite correct resistance.



Continued on next picture page

Checking idle actuator with the aid of actuator diagnosis.

N&gt;

Activate actuator diagnosis as described in Section "Self-diagnosis".

With flashing code 92, idle actuator should be periodically actuated (audible).

Actuation of idle actuator clearly audible ?

Y

V

Continued on next picture page

\*Detach 3-pole plug to actuator and measure winding resistances directly at idle actuator.

SET VALUES:

see brief instructions

If necessary, renew actuator. Pay attention to direction of flow.

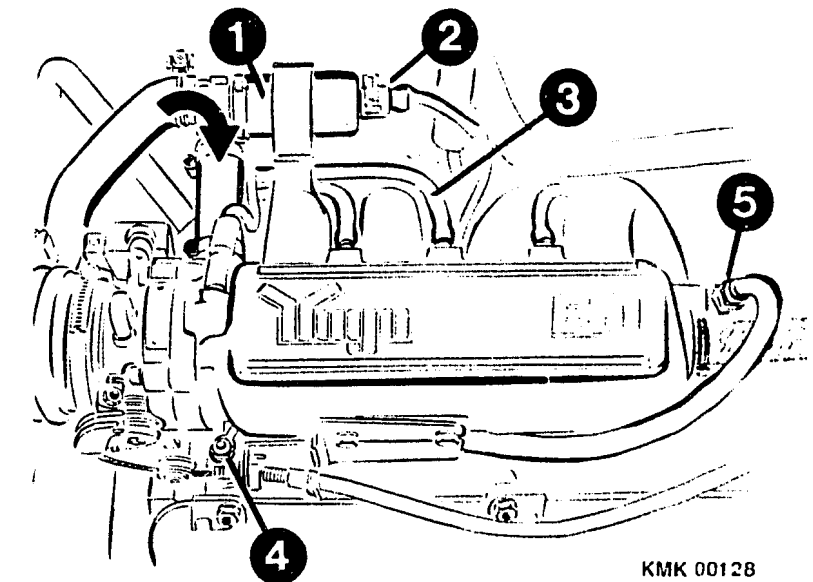
\*With ignition switched on, battery voltage (with respect to ground) must be present at center connection of idle actuator (term. 4), otherwise check continuity of center lead to main relay term.87 (+).

\*Rotary slider of idle actuator must not stick or catch. If necessary, renew actuator. Pay attention to direction of flow.

\*Check plug for corrosion and loose contacts. It must not be possible to push back spring contacts.

\*Check leads from control unit term.33 /34 to idle actuator term.5 /3 for continuity and short circuit (watch out for worn insulation).

\*Repeat activation of actuator diagnosis. Renew control unit if idle actuator is not actuated.



KMK 00128

1 = Idle actuator

2 = Plug

Arrow = Direction of flow



Checking tank-vent valve (TEV)  
with the aid of actuator diagnosis.

N&gt;

Activate actuator diagnosis as  
described in Section "Self-  
diagnosis".

With flashing code 94, TEV should  
be periodically actuated (can be  
felt and also heard).

Actuator diagnosis of TEV  
functioning ?

Y

Return to trouble-shooting chart  
B03

\* Check TEV winding with ohmmeter  
SET VALUE: 35...55  $\Omega$   
Renew TEV if necessary.

Note:

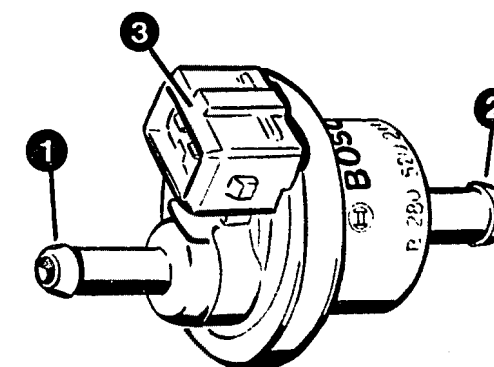
TEV may be defective despite  
correct resistance  
(mechanically blocked).

\* It must not be possible to push  
back spring contacts in TEV  
connector. Watch out for loose  
contacts.

\* Push back rubber sleeve at TEV  
connector and use oscilloscope  
(special input) to check signal  
profile at TEV with engine  
running (make use of suitable  
test prods).  
See bottom picture.

\* If no signal is visible, check  
TEV leads.  
With ignition switched on,  
battery voltage must be applied  
to one of the two leads  
(trouble-shooting in accordance  
with terminal diagram).  
Check second lead for continuity  
to control unit term.31.  
Spring contact No.31 in control-  
unit plug O.K. ? It must not be  
possible to push it back.

\* If leads, plug and TEV are O.K.,  
replace control unit.

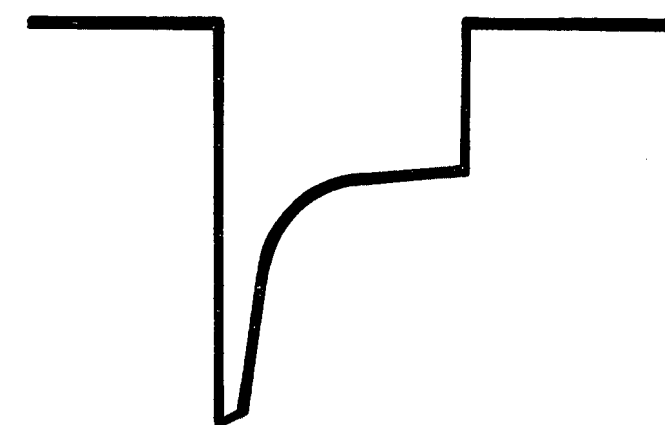


KMK 00146

Tank-vent valve (TEV)

1 = to active-carbon filter  
2 = Connection (to TES) on  
intake manifold end  
3 = Electrical connection

Signal at TEV



KMK 00147

# TROUBLE-SHOOTING PROGRAM ( 7 )

V

Measure signal at solenoid-operated injection valve.  
Test function and interference.

N>

Connect 2-pole test lead  
1 684 463 093 between one solenoid-operated injection valve and its connector.  
Connect Motortester (special input) to test lead.  
Connect black pickup to vehicle ground.  
Connect red pickup to one of the two connections of the test lead.

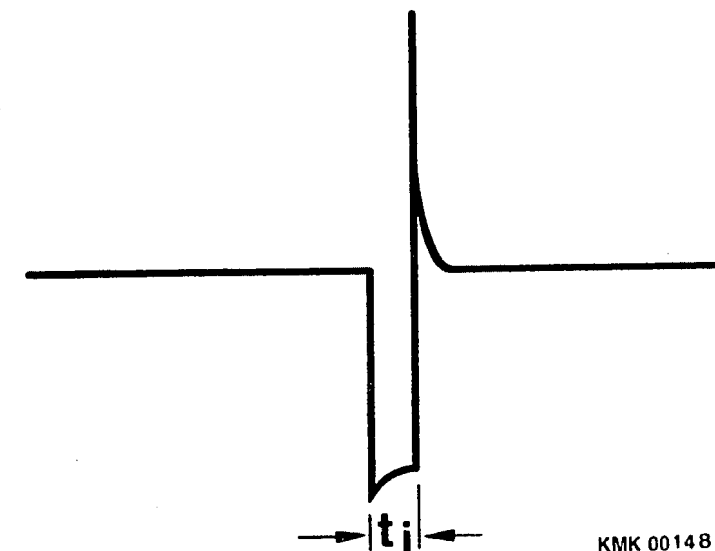
Start engine/let it run.  
Given correct connection, injection pulses are visible on the oscilloscope.  
If no pulse is visible, make contact between red pickup of tester and other pin in injection valve.

Correct injection signal present as shown in upper picture ?

\* No injection signal:  
Control unit defective (injection output stage)

\* Interference:  
Test routing of leads.  
Create wiring-harness/H.T. ignition cable spacing.  
Also test alternator (e.g. worn carbon brushes) and alternator regulator.

\* Missing:  
Test injection-valve plugs and all other connections.  
Spring contacts in plug must be engaged and it must not be possible to push them back.  
Contact surfaces must be bright.  
Move connections with engine running and pay attention to missing.



KMK 00148

Injection signal  
 $t_i$  = Duration of injection

Y  
V

Return to trouble-shooting chart  
B03

# TROUBLE-SHOOTING PROGRAM ( 8 )

Check fuel pressure with engine stopped.

N>

Measure pressure before pressure regulator. Measuring point at inlet of fuel-distribution pipe, at hose connection or at pressure damper (if applicable)

Loosen fuel-inlet hose.

**CAUTION!**

Catch escaping fuel; it must not get onto hot parts of the engine. Connect pressure tester KDJE-P100. Close valve screw. To connect, use three-way line KDJE-P100/13 (hose connection) or connecting part KDJE-P100/14 (screw connection M 14 x 1.5).

Make sure there are no leaks. Connect jumper into connection base (for pump relay) between term. 87 and term. 30. The electric fuel pump must operate.

Fuel pressure

SET VALUE: see brief instructions

Set value obtained?

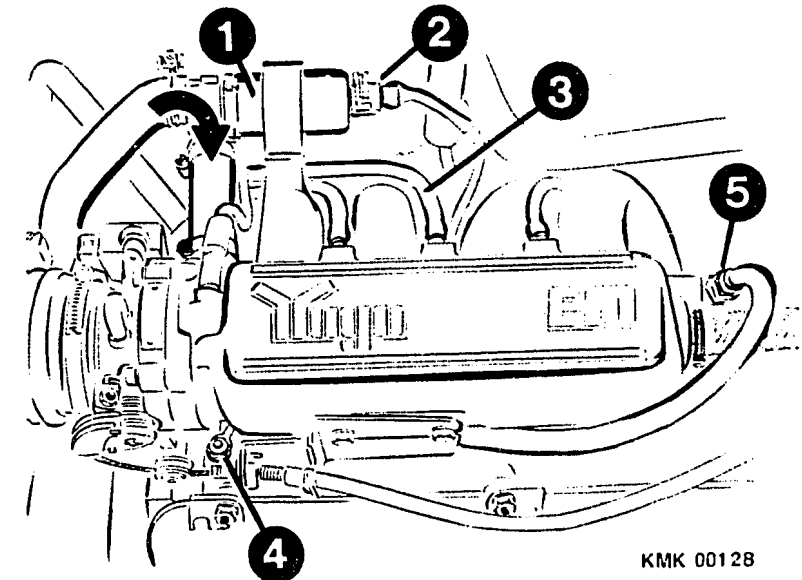
Set value is not attained because EFP (electric fuel pump) is not running (audible):

1. Check pump fuse and safety switch.
2. Measure voltage at detached EFP plug at fuel tank (bottom picture, arrow). Switch on ignition  
SET VALUE: battery voltage

\*If no voltage present at EFP: Check leads from EFP plug to pump relay term. 87 (red lead) as well as pump ground lead to vehicle ground for continuity. Battery voltage must be present at term. 30 in connection frame of pump relay (switch off ignition).

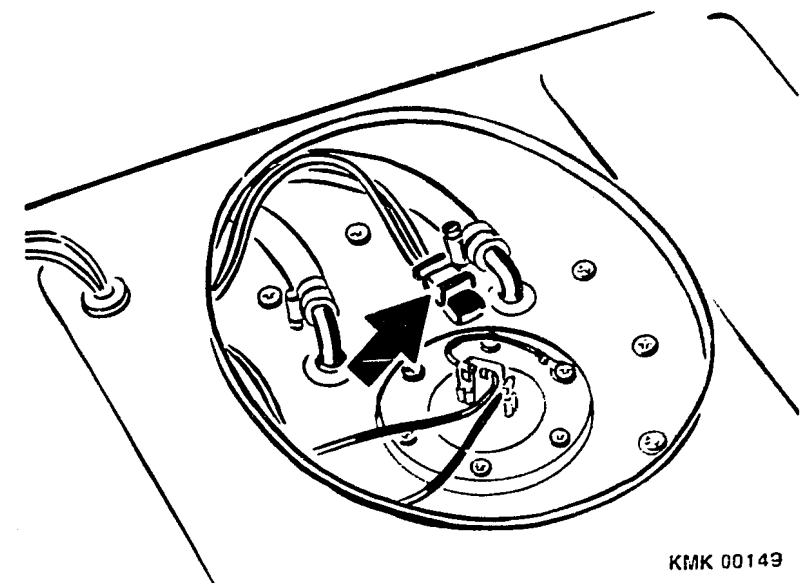
\*If voltage present: Measure resistance of fuel pump  
Set value: approx. 1  $\Omega$   
Note:  
The EFP may be defective despite correct resistance (mechanically blocked).

Perform hydraulic test on pressure regulator and fuel pump (see next picture page).



KMK 00128

5 = Pressure-gauge connection point at fuel-distribution pipe



KMK 00149

Continued on next picture page

Continued on next picture page

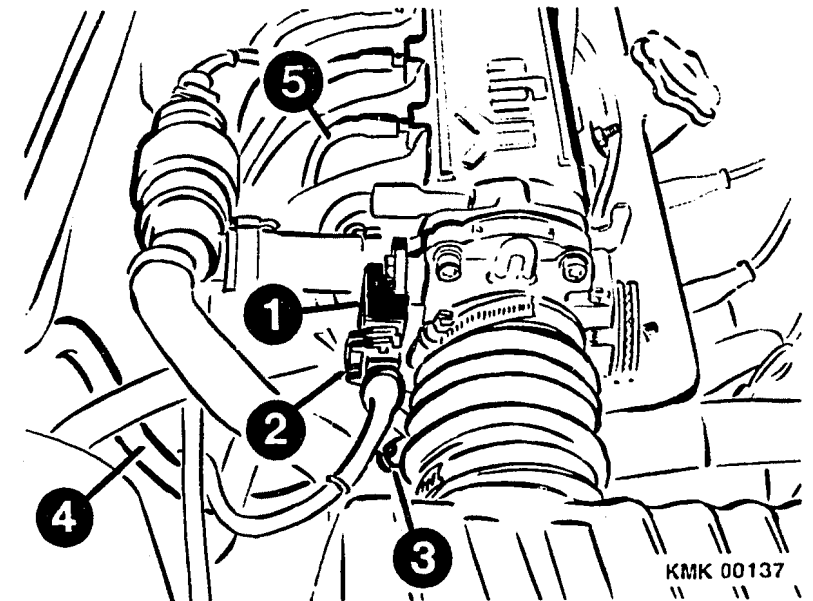
Set value is dropped below:

- \* Slowly pinch off fuel return line.  
Caution! Pressure must not increase to in excess of 6 bar.  
If pressure increases to in excess of 5 bar, renew pressure regulator.  
With O-ring sealing technique, use new O-rings.  
Apply small quantity of silicon grease (Ft 2 v 1).  
If pressure does not increase sufficiently, fuel pump is defective.
- \* Fuel filter heavily clogged, renew.
- \* Fuel pressure line or pressure damper (if applicable) clogged, renew.
- \* Filter in tank clogged.  
Corrosion in tank.

Set value is exceeded:

Detach fuel return hose from pressure regulator.  
Attach test hose to pressure regulator and route it into a 1.5 l measuring jug.  
Is set value now attained?

- 1.If yes, fuel return line clogged or squashed; renew.
- 2.If no, pressure regulator defective; renew.

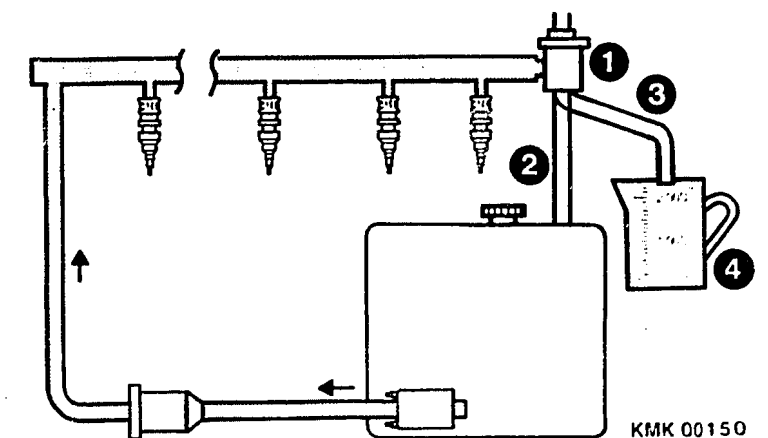


- 3 = Fuel-pressure regulator
- 4 = Fuel return line
- 5 = Intake-manifold-pressure connection of fuel-pressure regulator

————— Pressureless

||||||| Fuel pressure

- 1 = Pressure regulator
- 2 = Return
- 3 = Test hose
- 4 = Measuring glass



Continued on next picture page

Following test sequence  
applies only in the event of  
fault symptom "engine won't start".

Check whether engine starts  
with wire jumper in relay  
frame.

\*If not, continue trouble-shooting  
on next picture page.

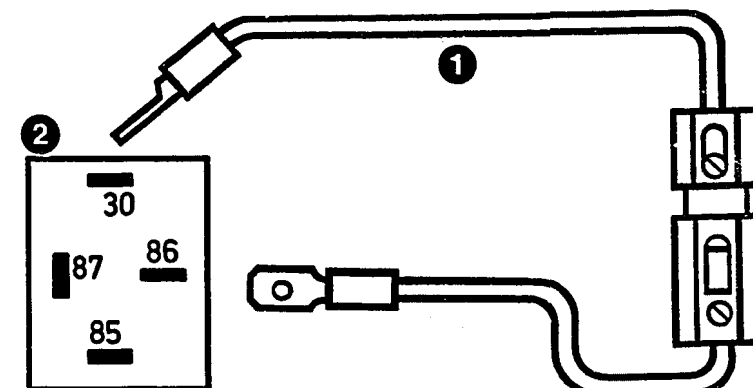
\*If engine starts, the  
following are possible  
causes of the trouble:

1. Open circuit in lead to control  
unit  
term. 20 to pump relay  
term. 85 (battery voltage must  
be present at term. 86  
in pump-relay frame with  
ignition switched on).
2. Pump relay defective.
3. Control unit (pump  
output stage) defective.

Leads and components O.K.

N>

\*Repair lead.  
\*Replace relay.  
\*Replace control unit.



1 = Jumper with fuse holder  
and 10 A fuse (user-  
fabricated)  
2 = Top view of connection  
base

Continued on next picture page

V

Check fuel pressure with engine running.

Let engine idle.

Fuel pressure  
SET VALUE: approx. 0.5 bar  
lower than with engine stopped.

Set value obtained?

N>

\*Intake-manifold-pressure energization of pressure regulator not O.K. Hose line between pressure regulator and intake manifold clogged or leaking -> replace.  
Hose line dropped off -> re-connect.

\*If intake-manifold-pressure energization O.K. -> replace pressure regulator.

Y

Continued on next picture page

# TROUBLE-SHOOTING PROGRAM ( 8 ) CONTINUED ( 4 )

Check fuel pressure after switching off engine (checking for leaks).

Fuel pressure  
SET VALUE: min. 1.0 bar  
after 20 minutes.

Set value obtained?

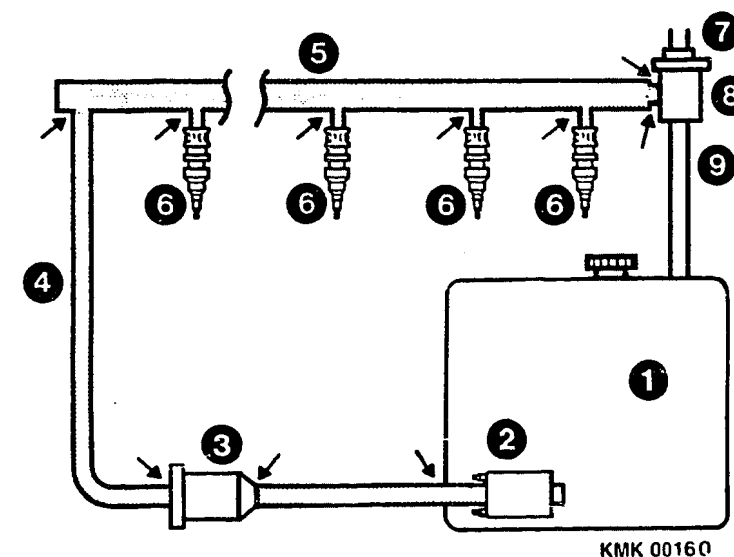
N>

\*Leaking at joints between components, fuel hoses and fuel lines → tighten hose binder or replace hose.

\*Pressure regulator (diaphragm) leaking → replace.

\*Electric fuel pump (non-return valve) leaking.  
With screw-type non-return valve → replace.  
With integral non-return valve → replace electric fuel pump.

\*Pressure damper or fuel filter leaking → replace.



KMK 00160

- 1 = Fuel tank
- 2 = Electric fuel pump
- 3 = Fuel filter
- 4 = Inlet, delivery line
- 5 = Fuel-distribution pipe
- 6 = Injection valves
- 7 = Intake-manifold pressure connection
- 8 = Pressure regulator
- 9 = Return line

Arrows = Possible leaks

After testing is finished:

Remove jumper and connect pump relay in connection base.

Remove pressure tester.  
Connect fuel-inlet hose to fuel-distribution pipe.  
Make sure there are no leaks.

Return to trouble-shooting chart B03

Continued on next picture page

\*Leak in injection valve(s)  
at point of connection with  
fuel distributor; renew  
O-ring. See text below.

\*Check injection valve(s)  
(needle seat) for leaks:

Remove complete fuel distributor.  
Supply and return remain  
connected. Simultaneously  
pull all injection valves  
out of intake-manifold guide.

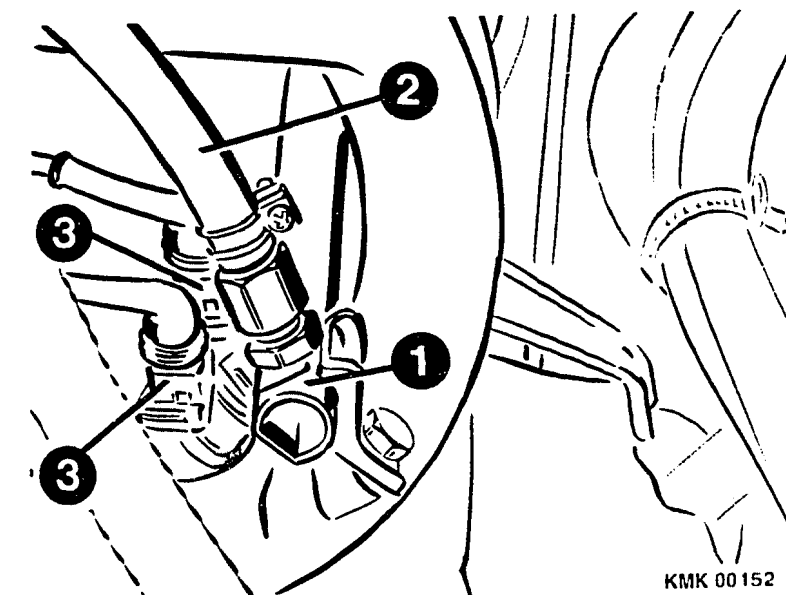
Fit jumper between term. 87  
and term. 30 in connection  
frame (pump relay).  
Electric fuel pump must  
run.

Set value:

No droplets may drip off the  
injection valve within 60 s.  
If they do so, renew injection  
valve.

Removal:

Detach connector.  
Pull out retaining clip.  
Remove injection valve.  
Caution!  
Catch any fuel which emerges.  
It must not be allowed to make  
contact with hot engine components.



1 = Fuel-distribution pipe  
2 = Fuel intake hose  
3 = Injection valves

Continued on next picture page



If injection valve (needle seat) is leakproof but O-ring is defective, then renew O-ring.

Use new parts set.  
Caution! Do not damage protection sleeve and valve needle.

Renew upper O-ring (fuel distributor) if it is damaged.

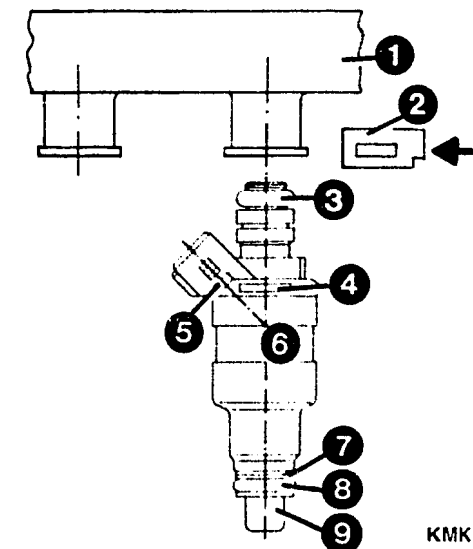
Cut up lower O-ring (intake manifold) if it is defective.  
Fit new O-ring over protection sleeve and its beading.

Installation:

Only grease O-rings slightly (silicone grease Ft 2 v 1).  
Attach injection valve to fuel distributor.  
Slip retaining clip into groove and allow it to engage.  
Check for fuel leaks.  
Fit connector.

Install complete fuel distributor.  
In doing so, press all injection valves evenly into intake-manifold guide.  
Caution!  
Do not damage O-rings and/or valve needles.  
Make sure there are no intake-manifold leaks.

Return to trouble-shooting chart B03



KMK 00153

- 1 = Fuel-distribution pipe
- 2 = Holding clamp
- 3 = Upper O-ring
- 4 = Part number
- 5 = Date of manufacture
- 6 = Injection valve
- 7 = Supporting plate
- 8 = Lower O-ring
- 9 = Protective sleeve

# TROUBLE-SHOOTING PROGRAM ( 9 )

Check fuel delivery.

Measure fuel delivery of electric fuel pump against pressure. Therefore, measuring point at return, after pressure regulator.

Disconnect fuel-return hose from pressure regulator.  
Mount test hose on pressure regulator and lead into a 1.5 l measuring glass.  
Disconnect pump relay.  
Connect jumper into connection base between term. 87 and term. 30.  
The electric fuel pump must operate. Measuring time 30 sec.

Fuel delivery  
SET VALUE: See brief instructions

Set value obtained?

After testing is finished:

Remove jumper and connect pump relay in connection base.

Remove test hose and mount fuel return hose on pressure regulator. Make sure there are no leaks.

Return to trouble-shooting chart B03

N>

\*Fuel filter heavily soiled, replace.

\*Fuel pressure line or pressure damper (if fitted) blocked, replace.

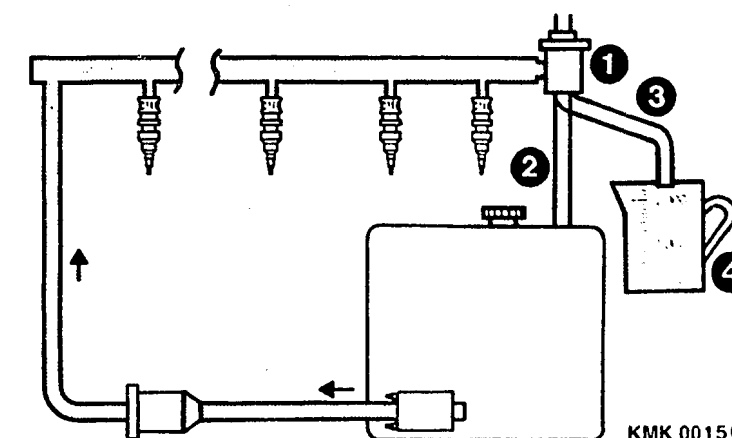
\*Voltage at electric fuel pump with engine running, min. 12 V. If not, clean contacts, remedy poor ground connection, replace leads.

\*Check pre-supply pump (if fitted). Measuring point: Line between the pumps. Delivery quantity must be at least 10% greater than that of electric fuel pump. If not, replace pre-supply pump.

\*If fuel-pump output is too low, replace electric fuel pump, clean connecting points before separation to prevent dirt from entering fuel system. In-tank electric fuel pumps are accessible via a plug on the tank.

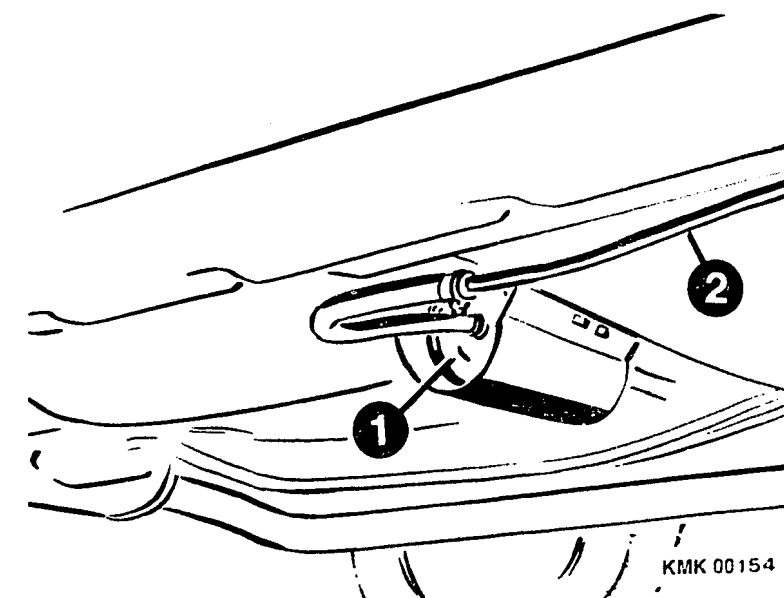
\*If electric fuel pump is noisy (vapor bubbles), suction line restricted or kinked, replace. Strainer in tank blocked, replace. Corrosion in tank, clean or replace.

\*Pressure reg. defective, check.



Pressureless  
Fuel pressure  
1 = Pressure regulator  
2 = Return  
3 = Test hose  
4 = Measuring glass

1 = Fuel filter  
2 = Fuel intake line



## TROUBLE-SHOOTING PROGRAM (10)

↓

### Check air-intake system

Check whether hoses of air-intake system are correctly connected, not kinked or damaged.

Check whether oil dipstick has been inserted as far as it will go and whether the seal on the oil filler-neck cap is O.K.

With catalytic-converter models, check also that the tank-ventilation system (if applicable) is not leaking (visual examination).

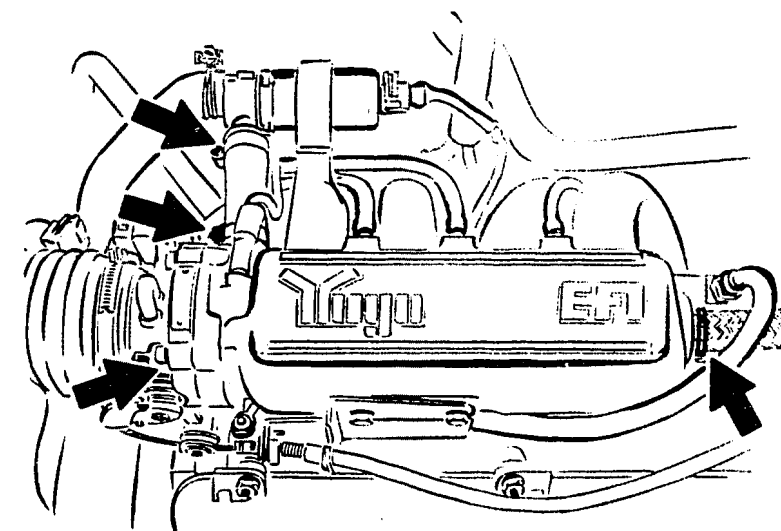
Are all hoses O.K.?

N>

Replace hoses if necessary. Eliminate leaks by means of new seals or by retightening the hose clamps.

↓

Continued on next picture page



KMK 00 155

Arrow = Sealing points of  
air-intake system

## Air-intake-system leak test

Seal off exhaust tailpipe and possibly also intake-manifold connection.

Use compressed-air gun to inject air (0.3 bar gauge) into intake manifold at suitable location (e.g. air hose of fuel-pressure regulator).

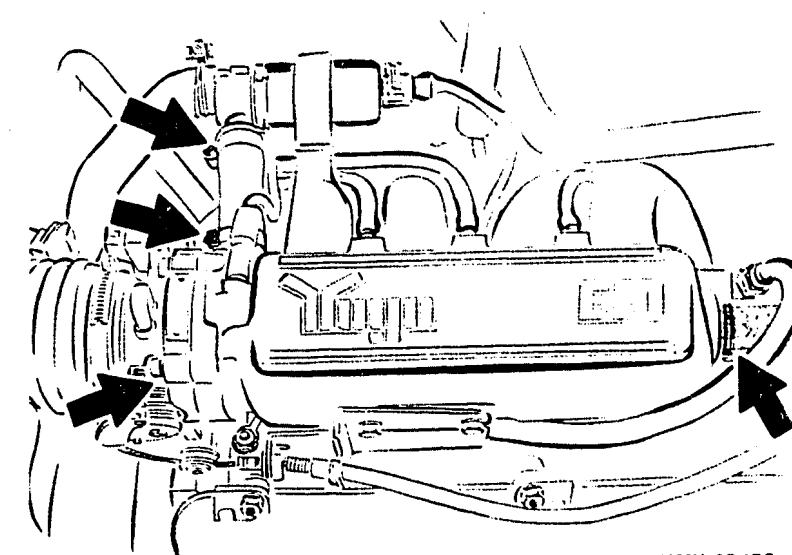
Use leak detector spray or soapy water to spray over/brush over all sealing points.  
Bubbles or foam are an indication of leaks.

Are all sealing points leakfree ?

N&gt;

Eliminate leaks by means of new seals or by retightening the hose clamps.

Leaks may also occur at the following points: oil dipstick not securely inserted, defective seal at oil filler-neck cap etc.



KMK 00 155

Arrow = Sealing points of  
air-intake system

Return to trouble-shooting chart  
B03

# TROUBLE-SHOOTING PROGRAM (11)

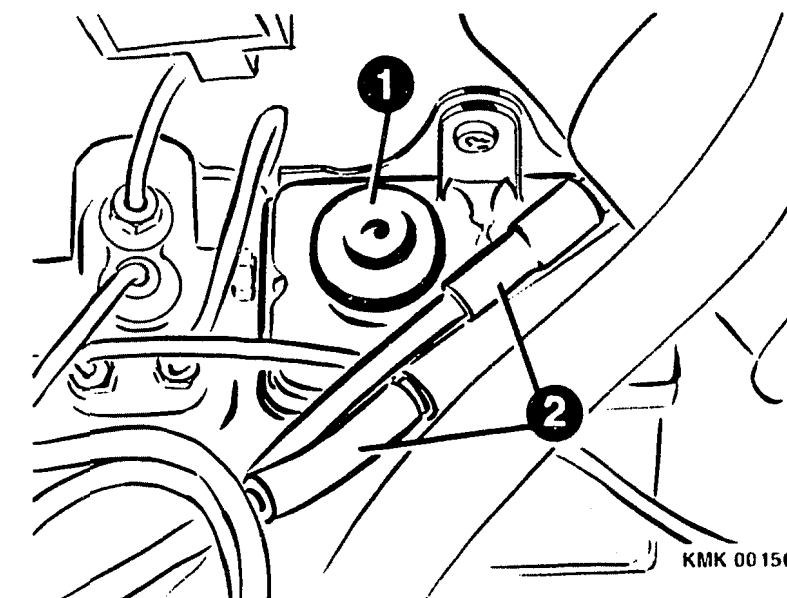
Check tank-ventilation system.

Check visually whether hoses of tank-ventilation system are correctly attached, not bent or damaged.  
Check whether hose connections at intake manifold, tank bleeder valve, active-carbon canister and fuel tank are leak-tight.

Are all hoses and connections O.K.?

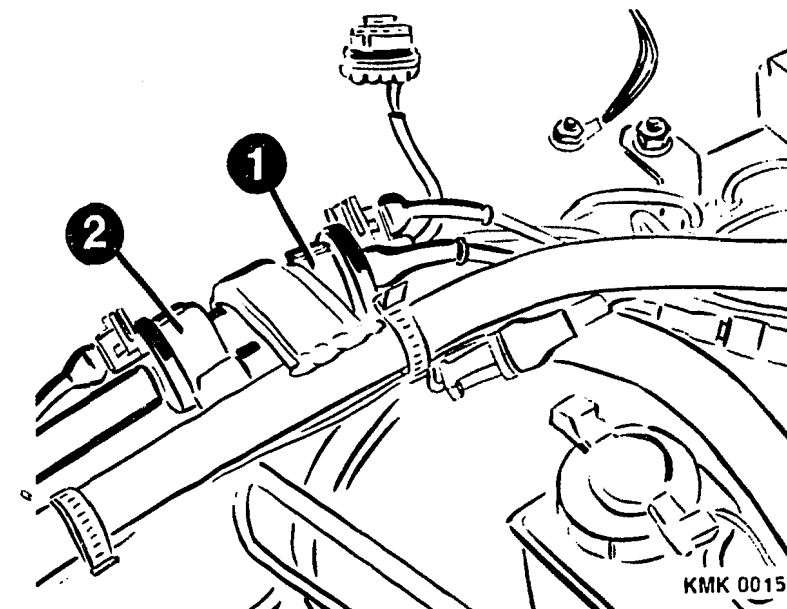
N>

Replace defective hoses as necessary.  
Eliminate leakages by tightening hose clamps.



1 = Active-carbon filter  
2 = Hoses of tank ventilation system

1 = Tank-vent valve (TEV)  
2 = Tank-ventilation switching valve (TES)



Continued on next picture page

Tank-vent-valve (TEV) leak test.

N&gt;

Renew tank-vent valve.

Remove TEV.

Connect vacuum pump (e.g. Mityvac) to valve connection on intake-manifold end.

1. Valve deenergized:

No throughput, i.e. vacuum can be built up

2. Actuate valve with battery voltage (12 V); in doing so make use of connecting lead KDJE-7450/70.

Generate negative pressure of approx. 0.5 bar.

The vacuum only drops off slowly if the TEV is intact.

Approximate value:

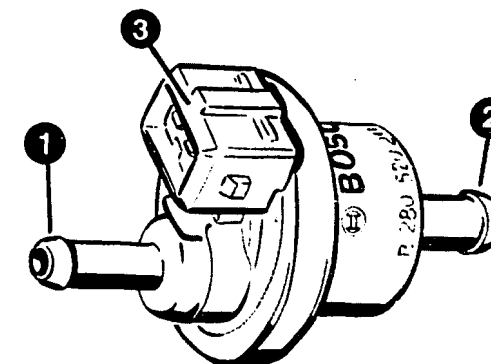
Drop in negative pressure from 0.5 to 0.25 bar at 12 V in approx. 10 s permitted.

3. Valve deenergized.

Seal off other connection, build up negative pressure of approx. 0.5 bar.

There must be no decrease in vacuum.

TEV O.K. ?



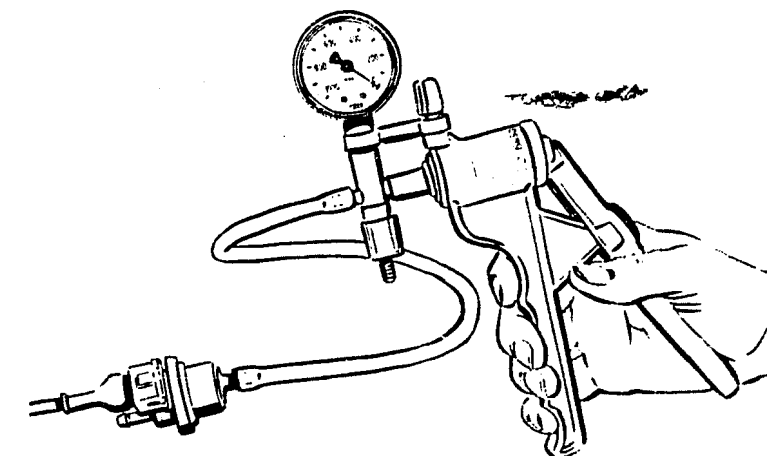
KMK 00146

Tank-vent valve (TEV)

1 = to active-carbon filter

2 = Connection (to TES) on intake manifold end

3 = Electrical connection



KMK 00159

Continued on next picture page

Checking tank-ventilation switching valve (TES)

Connect vacuum pump (e.g. Mityvac) to valve connection on intake-manifold end.

1. Ignition switched off  
(no voltage at valve):  
no throughput, i.e. vacuum  
be built up.

2. Ignition switched on:  
throughput, i.e. vacuum  
cannot be built up.

Tests positive ?

N>

Re 1:

\* Renew tank-ventilation switching valve.

Re 2:

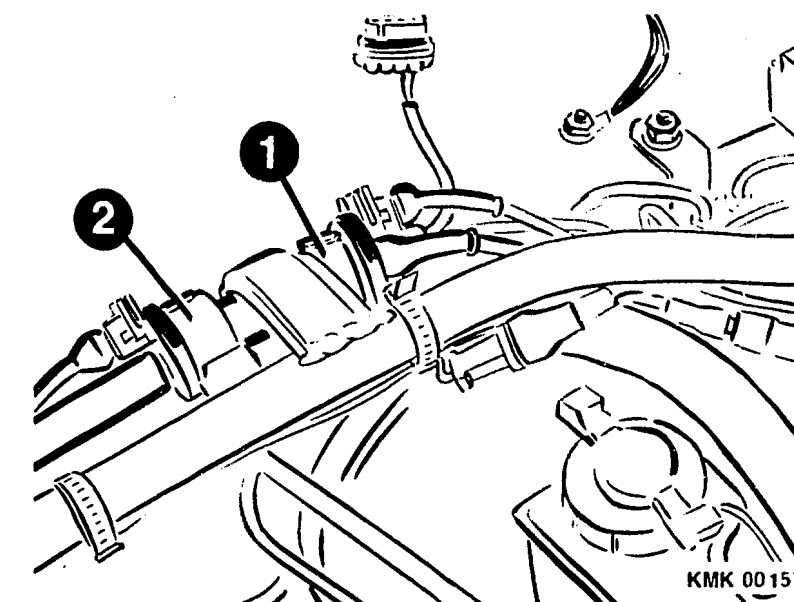
\* Check winding resistance of TES

SET VALUE: 35...55  $\Omega$

\* Check whether battery voltage (approx. 12 V) is applied to TES plug with ignition switched on.

If this is not the case, check ground and positive lead (to main relay term. 87) on TES for continuity.

If yes, renew tank-ventilation switching valve.



1 = Tank-vent valve (TEV)

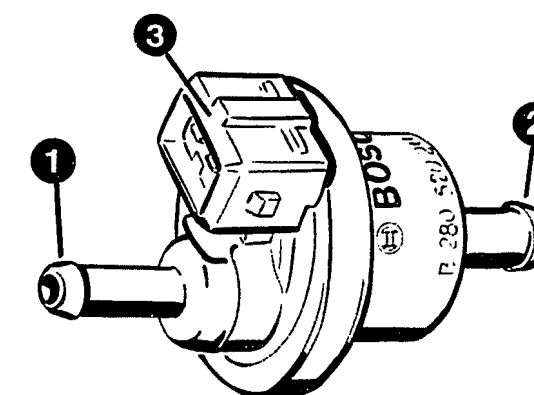
2 = Tank-ventilation switching valve (TES)

Tank-ventilation switching valve (TES)

1 = Connection on intake manifold end

2 = to TEV

3 = Electrical connection



Return to trouble-shooting chart B03

KMK 00146

# TROUBLE-SHOOTING PROGRAM (12)

↓

Check overrun cutoff:  
Connect test lead 1 684 463 093 between one solenoid-operated injection valve and its connector. Engine tester set to special input, black clip to vehicle ground. Allow engine at operating temperature to idle.

## NOTE:

In view of the fact that the terminal assignments of the injection-valve plugs are not standard, the negative lead of the injection valve must be determined. To do so, initially connect red clip of engine tester to one lead (use measurement lead for test prods, avoid short circuit). Important: the free terminal of the test lead must not come into contact with ground.

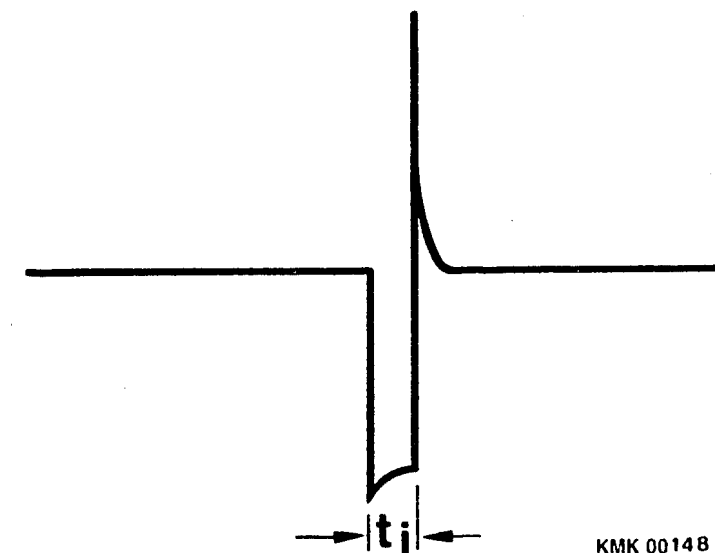
If no injection pulses are visible, connect red clip to other lead. Run engine at 3000 min<sup>-1</sup>. Injection signals are visible (see top picture).

Suddenly release accelerator pedal. As engine speed decreases, injection signals are suppressed and cut in again above idle speed.

Overrun cutoff O.K. ?

N>

- \* Repeat test.
- \* Check throttle-valve sensor.
- \* Control unit defective.



Injection signal  
 $t_i$  = Duration of injection

↓

Return to trouble-shooting chart  
B03



# TROUBLE-SHOOTING PROGRAM (13)

\* Check idle speed:

Connect motortester according to operating instructions. Engine at operating temperature, switch off electrical equipment. Set automatic transmission to N or P.

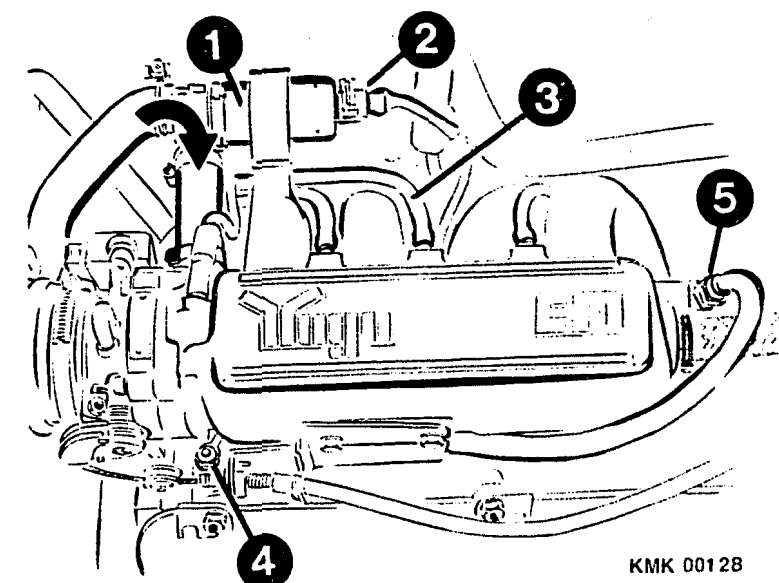
SET VALUE: See brief instructions

Set value obtained?

\* Check idle actuator.

\* Check throttle-valve sensor.

\* Control unit defective.



KMK 0012B

1 = Idle actuator

2 = Plug

Arrow = Direction of flow

Return to trouble-shooting chart  
B03

E21



E22



V

## Exhaust-gas (CO) test:

## Measurement conditions:

Engine at operating temperature,  
electric loads switched off,  
prescribed idle speed, seal crank-  
case breather hose, set automatic  
transmission to N/P.

## 1. Vehicles with no catalytic converter:

Connect exhaust-gas analyzer to  
exhaust tailpipe and determine  
CO.

SET VALUE: 0.5...1.5 vol. %

## 2. Vehicles with catalytic converter:

Measure CO ahead of catalytic  
converter (if sampling point  
provided) and at exhaust tail-  
pipe.

The CO content downstream of  
the catalytic converter must be  
considerably less than ahead of  
the catalytic converter; other-  
wise the catalytic converter is  
defective.

Values around 0 vol. % CO are  
generally measured at the exhaust  
tailpipe.

SET VALUES: see brief instr.

## Note:

Monitoring and basic adjustment  
of the mixture are carried out  
by the adaptive lambda closed-  
loop control (by way of lambda  
sensor); there is thus no need  
to make any adjustments.

Set values O.K. ?

N&gt;

## 1. Vehicles with no catalytic converter:

Adjustment potential for  
mixture (CO) at CO potentio-  
meter:

\*Turn potentiometer in a clock-  
wise direction, CO increases  
(injection time is extended).

\*Turn potentiometer in a counter-  
clockwise direction, CO decreases  
(injection time becomes shorter).

## Note:

Adjustment range for injection  
time is  
max. 0.6 ms.

## 2. Vehicles with catalytic converter:

\*Check air-intake system and  
exhaust system (in particular  
ahead of lambda sensor) for  
leaks.

\*Check tank ventilation.

\*Lambda sensor defective.

\*Control unit defective.

\*If CO too high downstream of  
catalytic converter:

Catalytic converter at operating  
temperature in perfect mechanical  
working order (visual inspect.)?

Refer to trouble-shooting chart  
for further possible faults.

V

Return to trouble-shooting chart  
B03

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